NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY

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NGA STANDARDIZATION DOCUMENT

National System for Geospatial Intelligence (NSG) Core Vocabulary (NCV) Standard

(2018-05-23)

Edition 2.0

NATIONAL CENTER FOR GEOSPATIAL INTELLIGENCE STANDARDS

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Introduction

The NSG Core Vocabulary (NCV) Standard document ("NCV Standard") defines the specification for a controlled vocabulary of terms intended for use in the National System for Geospatial Intelligence (NSG) community to consistently and unambiguously refer to elements of shared Geospatial Intelligence (GEOINT). A controlled vocabulary is a set of terms consisting of defined lexical items (*i.e.*, words, phrases, or abbreviations from a natural language) that are collected and managed by an authority following identified criteria for inclusion. The criteria for inclusion in the NCV are determined by NSG requirements. This NCV Standard specifies the vocabulary information model, two encoding patterns, and a governance process for managing the vocabulary.

The content of the NSG Core Vocabulary ("NCV content") consists of specific NSG vocabulary terms to be used for describing GEOINT data. The NCV content is represented as a formal terminology using the World Wide Web Consortium (W3C) Simple Knowledge Organization System (SKOS). The NCV content is specified separately from the NCV Standard in officially published technical artifacts which contain vocabulary encodings implemented in accordance with two W3C Recommendations: RDF 1.1 XML ("RDF/XML") and RDF 1.1 N-Triples.

The NCV enables the semantics (*i.e.*, meaning) of GEOINT information published on the Web to be represented based on well-known International Standards and W3C Recommendations.[1] In this way, the NCV supports NSG-wide efforts to build a linked open data store of GEOINT resources (*e.g.*, documents, objects, and data instances) having consistent, integrated, machine-processable semantics usable by creators and consumers of GEOINT. The specific purpose of the NCV content is to promote consistent semantics in applications that provide terminology services, tagging and/or indexing, search, display of resources, and related Web services for GEOINT data.

Both the NCV Standard and NCV content are developed and managed under the authority of the National Geospatial-Intelligence Agency (NGA) as a Standards Development Organization (SDO). The NCV Standard and the associated normative NCV content encodings are available as registered technical artifacts in the online NSG-unique Standards Register of the NSG Standards Registry. The vocabulary terms specified in the NCV content are managed in the online NCV Register of the NSG Vocabulary Registry. Individual vocabulary terms are retrievable through the REST API component of the NSG Standards Registry.

The NSG vocabulary specification defined in the NCV Standard is the basis for the NCV content published in technical artifacts that are registered vocabulary resources. Additional NSG vocabularies also follow this vocabulary specification.

[1] *Data on the Web Best Practices, a W3C Recommendation* (31 January 2017). Latest version available online at: http://www.w3.org/TR/dwbp/. Guidance on the production of data instances falls outside the scope of this standard.

Revision History

Description	Date	Edition
Initial Edition	06/01/2017	1.0
Edition 2.0 changes: (1) NSG Vocabulary Specification (Section 5): (a) added CollectorTerm (for NEV); (b) generalized 'valuesComplete' to 'domainComplete'; (c) added hierarchical associations for ComplexVocabularyTerms. Includes both modifications to the model and the encodings. (2) Conformance: Extensions of Section 2 and Annex A (Abstract Test Suite, Class D) to cover NEV and general conformance; Annex B: Revisions to IC Pro Forma to support changes in Annex A. (3) Annex C (NEV): Specification expanded and IRIs revised; (4) Annex D (NCVX utility ontology): Added classes (BasicVocabularyTerm, ComplexVocabularyTerm, CollectorTerm); renamed 'valuesComplete' to 'domainComplete'; added properties broaderComplexTerm and narrowerComplexTerm (with transitive super-properties).	05/23/2018	2.0

1 Scope

The NSG Core Vocabulary (NCV) Standard document ("NCV Standard") defines the specification for a controlled vocabulary of terms intended for use in the National System for Geospatial Intelligence (NSG) community to consistently and unambiguously refer to elements of shared Geospatial Intelligence (GEOINT). A controlled vocabulary is a set of terms consisting of defined lexical items (*i.e.*, words, phrases, or abbreviations from a natural language) that are collected and managed by an authority following identified criteria for inclusion. The criteria for inclusion in the NCV are determined by NSG requirements. This NCV Standard specifies the vocabulary information model, two encoding patterns, and a governance process for managing the vocabulary.

The content of the NSG Core Vocabulary ("NCV content") consists of specific NSG vocabulary terms to be used for describing GEOINT data. The NCV content is represented as a formal terminology using the World Wide Web Consortium (W3C) Simple Knowledge Organization System (SKOS). The NCV content is specified separately from the NCV Standard in officially published technical artifacts which contain vocabulary encodings implemented in accordance with two W3C Recommendations: RDF 1.1 XML ("RDF/XML") and RDF 1.1 N-Triples. Each technical artifact has the same NCV content, encoded using one of those two W3C formats.

The NSG vocabulary specification defined in the NCV Standard is the basis for encoding the NCV content and other NSG vocabularies that conform to this standard.

The NCV Standard is presented in support of collaborative efforts across the NSG to build a linked open data store of GEOINT data with machine-processable semantics. The NCV content promotes consistent semantics in applications that provide terminology services, tagging and/or indexing, search, display of resources, and related Web services for GEOINT data.

Guidance on the production of data instances falls outside the scope of this standard.

Both the NCV Standard and NCV content are developed and managed under the authority of the National Geospatial-Intelligence Agency (NGA) as a Standards Development Organization (SDO). The NCV Standard and the associated normative NCV content encodings are available as registered technical artifacts in the online NSG-unique Standards Register of the NSG Standards Registry hosted by the NGA.[2] The vocabulary terms specified in the NCV content are managed in the online NCV Register of the NSG Vocabulary Registry.[3] Individual vocabulary terms are retrievable through the REST API component of the NSG Standards Registry. The NCV Standard and the associated content of the NSG Core Vocabulary evolve in response to NSG community requirements. The governance process, including publication of resources, is described in Section 6.

The NGA is the authority for promulgating the NCV Standard and its accompanying technical artifacts for use by the U.S. Department of Defense (DoD), U.S. Intelligence Community (IC), and U.S. civil federal agencies.

2 Conformance

2.1 Conformance Requirements

Any product claiming conformance to the NCV Standard shall pass all applicable requirements stated in the abstract test suite (ATS) in Annex A, which enumerates the specific elements of conformance in accordance with the conformance classes.

This standard defines four classes of conformance:

- Conformance Class A – Conformance for the Complete NCV Content
- Conformance Class B – Conformance for a Subset of the NCV Content
- Conformance Class C – Conformance for use of the NCV Content (Class A or Class B) with Extensions.
- Conformance Class D – Conformance to the NSG Vocabulary Information Model

Classes A, B, and C apply to implementations that claim conformance to the NCV Standard and NCV content. These implementations shall use one of the two official encodings of the NCV content (RDF/XML or N-Triples). Conformance may be claimed for data or software products, for services, and by specifications, including functional standards. The kinds of applications expected to make use of the NCV Standard and registered NCV content include:

[2] This edition of the NCV Standard is available from the NSG Registry, at: http://nsgreg.nga.mil/doc/view?i=4510.
[3] The NCV Register (http://nsgreg.nga.mil/voc/registers.jsp?register=NCV) is an online, dynamic information resource whose content is structured in accordance with the NCV Standard information model.

1) development of controlled vocabularies by creating subsets of, or extensions to, the NCV content;
2) terminology services (which provide terms, definitions, and synonyms for terminology used in shared data);
3) indexing, metadata tagging, and/or search applications that use machine-processable terminology; and
4) development of menus and other labeling for graphical data displays.

Class D applies to implementations that claim conformance to the NSG vocabulary information model for definition and encoding of non-NCV content. This covers NEV component vocabularies as well as external products claiming conformance to the information model in this standard.

2.2 Abstract Test Suite

The abstract test suite (ATS) for the NSG vocabulary specification is in Annex A (normative).

3 References

3.1 Normative References

The documents listed in Table 1 are indispensable to understanding and using this standard. For dated references, only the cited edition or version applies. For undated references, the latest edition or version of the referenced document (including any amendments) applies.

Table 1 – Normative References

Standard or Specification
NSG Core Vocabulary (NCV) content, encoded in technical artifacts: http://nsgreg.nga.mil/ncv
NSG Enterprise Vocabulary (NEV) content, encoded in technical artifacts: http://nsgreg.nga.mil/nev
IETF RFC 3987, *Internationalized Resource Identifiers (IRIs)*: http://www.ietf.org/rfc/rfc3987.txt
IETF RFC 5646, BCP 47, Tags for Identifying Languages: http://www.ietf.org/rfc/bcp/bcp47.txt
W3C *SKOS Simple Knowledge Organization System* (18 August 2009): http://www.w3.org/TR/2009/REC-skos-reference-20090818/
RDF 1.1 Concepts and Abstract Syntax, 25 February 2014: http://www.w3.org/TR/2014/REC-rdf11-concepts-20140225/
RDF 1.1 N-Triples: A line-based syntax for an RDF graph (25 February 2014): http://www.w3.org/TR/n-triples/
RDF 1.1 XML Syntax (25 February 2014) http://www.w3.org/TR/rdf-syntax-grammar/
W3C *rdf:PlainLiteral: A Datatype for RDF Plain Literals (Second Edition)* (11 December 2012): http://www.w3.org/TR/2012/REC-rdf-plain-literal-20121211/
DCMI Metadata Terms (14 June 2012): http://dublincore.org/documents/dcmi-terms/
GEOINT Content Standards Board (GCSB) Operations Guide. NGA.SIG.0029_1.0_GCSB: http://nsgreg.nga.mil/doc/view?i=4284
Style Guide for Vocabularies in the National System for Geospatial Intelligence (NSG). NGA.SIG.0030_1.0_VSTY: http://nsgreg.nga.mil/doc/view?i=4550

3.2 Informative References

The informative (non-normative) documents listed in Table 2 are useful to understanding and using this standard. For dated references, only the cited edition or version applies.

Table 2 – Informative References

Standard or Specification
ISO 19103:2015. *Geographic information – Conceptual schema language* (December 2015): http://www.iso.org/standard/56734.html
ISO 19105:2000. *Geographic information – Conformance and testing* (15 December 2000): http://www.iso.org/standard/26010.html
ISO 19110:2016. *Geographic information – Methodology for feature cataloguing* (December 2016): http://www.iso.org/standard/57303.html
ISO 19135-1:2015. *Geographic information – Procedures for item registration – Part 1: Fundamentals*: http://www.iso.org/standard/54721.html
ISO 19150-2:2015. *Geographic information – Ontology – Part 2: Rules for developing ontologies in the Web Ontology Language (OWL)*: http://www.iso.org/standard/57466.html
ISO/IEC 10646:2012, *Information technology – Universal Coded Character Set (UCS)*: http://www.iso.org/standard/56921.html
IETF RFC 1738, *Uniform Resource Locators (URL)*: http://www.ietf.org/rfc/rfc1738.txt
IETF RFC 3986, *Uniform Resource Identifiers (URI): Generic Syntax*: http://www.ietf.org/rfc/rfc3986.txt
W3C *OWL 2 Web Ontology Language: Structural Specification and Functional-Style Syntax (Second Edition)*, 11 December 2012: http://www.w3.org/TR/2012/REC-owl2-syntax-20121211/
W3C XML Schema Definition Language (XSD) 1.1 Part 2: Datatypes (5 April 2012): http://www.w3.org/TR/xmlschema11-2/
Shorter Oxford English Dictionary, *Sixth Edition* (version 3.0.2.1). CD-ROM.

4 Terms, Definitions, and Acronyms

4.1 Terms and Definitions

Terms and definitions[4] used in this standard are presented in Table 3.

Table 3 – Definitions Applicable to the NCV Standard

Term	Definition
annotation	An expression used to associate information with an ontology or other resource. NOTE1: An annotation is additional information associated to ontologies or ontology components that is intended for human consumption and not for use by reasoning software. NOTE2: Each annotation consists of an annotation property and an annotation value. SOURCE: OWL 2 Structural Specification (Section 3.5; Section 10)

[4] In definitions, a term is styled in **bold** when the meaning of that term is specified elsewhere in Section 4.1.

Term	Definition
axiom	A statement of something that is true in the universe of discourse (domain). NOTE1: Axioms in OWL 2 can be declarations, axioms about classes, axioms about object or data properties, datatype definitions, keys, assertions (sometimes also called *facts*), and axioms about **annotation**s. SOURCE: OWL 2 Structural Specification (Section 9) NOTE2: A universe of discourse is a view of the real or hypothetical world that includes everything of interest. SOURCE (NOTE2): ISO 19150-2 citing ISO 19101-1:2014 (Clause 4.1.38)
basic vocabulary term	A **vocabulary term** that represents a **concept** of one type, aspect, relationship, or value that is used to describe real-world phenomena. NOTE: A basic vocabulary term may be used to describe either a specific type of entity, a relationship of an entity to another entity, an attribute of an entity, or a value of an attribute. EXAMPLES: “Body of Water”, “Depth”, “800 Meters”, “Event”, “Participant”, “Damaged”.
blank node	A node in an RDF graph that is distinct but has no **IRI** identifier. NOTE: A blank node cannot be referred to outside of its local graph. When stronger identification is needed, a blank node may be replaced and represented in the graph with a new, globally unique IRI (a Skolemized IRI) corresponding to the blank node. SOURCE: RDF 1.1 Concepts and Abstract Syntax (Sections 3.4, 3.5)
change notification (regarding a standard)	A publication in which modifications to selected items in a standard are reported in detail to the community of its users by the applicable maintenance authority. NOTE: In the NCV Standard, a change notification is used to establish a new **content baseline**. SOURCE: GCSB Operations Guide
complex vocabulary term	A **vocabulary term** that represents a **concept** that describes a domain of related types or values that may be used to describe real-world phenomena. NOTE: The domain denoted by a complex vocabulary term may be a subject domain (of entity and/or attribute types) or a value domain (of possible attribute values). Specific types or values in the domain are denoted by **basic vocabulary term**s. EXAMPLE1: (*Subject domain*) “Coordinate Reference System Terms”, a collection of terms each member of which denotes a coordinate system that is related to an object by a datum. EXAMPLE2: (*Value domain*) “Biological Sex”, representing the value domain of all single concepts that may be used to describe the biological sex of a (sexual) living organism.
concept	A mental representation of knowledge as an abstraction of the essential characteristics of a type of entity, or relationship between entities, in a subject area or domain. NOTE: Usually the abstraction is based on a generalization from experience. SOURCE: *The Semantic Web*. Michael C. Daconta, Leo J. Obrst, Kevin T. Smith. 2003.
content baseline (of a standard)	The complete set of content of a standard, which is authorized for publication at a specified time. NOTE1: A content baseline is established by publication of a technical artifact containing the content that is valid at that time. NOTE2: Content baselines may be established concurrent with the publication of a new edition of a standard, or solely based on changes to the content of a standard. SOURCE: GCSB Operations Guide (Section 2.3.5)
controlled vocabulary	A set of **vocabulary term**s consisting of defined **lexical item**s (*i.e.*, words, phrases, or abbreviations from a natural language) that are collected and managed by an authority following identified criteria for inclusion. NOTE: Typically, the set of terms and definitions in a controlled vocabulary are selected for consistent and complete coverage of a specified subject area.

Term	Definition
edition (of a standard)	A publication containing the entire current content of an established standard, and issued by the authorized publication authority, either as the first edition of a new standard or as a new edition (*i.e.*, revised complete version, usually numbered; for example, "2nd edition") of a previously published standard. SOURCE: GCSB Operations Guide
Internationalized Resource Identifier (IRI)	A sequence of characters from the Universal Character Set (Unicode/ISO 10646) [IETF RFC 3987], intended for identifying an abstract or physical resource. NOTE1: Every **URI** is by definition an IRI. A mapping from IRIs to URIs is defined, which means that IRIs can be used instead of URIs, where appropriate, to identify resources. SOURCE (NOTE1): IETF RFC 3987 NOTE2: A resource can be anything that has identity, *e.g.*, an OWL class instance and its associated annotations. NOTE3: OWL 2 extends OWL 1 by using IRIs to identify ontologies and their elements. OWL 1 uses Uniform Resource Identifiers (URIs). SOURCE (NOTE3): OWL 2 Structural Specification (Section 2.4)
lexical item	A word, phrase, or abbreviation represented as a character string that expresses content in a specified natural language.
namespace	In RDF, a common **URI** prefix or stem (including a terminal separator) used in identifiers for a set of related resources. NOTE1: The RDF namespace is concatenated with the local name to create the complete URI identifier for an RDF resource. NOTE2: Every RDF resource is identified by a URI. SOURCE (NOTE2): ISO 19150-2:2015 NOTE3: The NCV Standard uses the standard prefix names for namespaces as declared in the OWL Structural Specification (Section 2.4).
semantic relation	A formal link between two **vocabulary term**s that characterizes the relationship between the meanings of the terms (for example, that the meaning of one term is more general than the meaning of the other term, or that it is more specialized). SOURCE: SKOS Reference (Section 8)
structured vocabulary	A set of **vocabulary term**s that are related by **semantic relation**s. NOTE: A structured vocabulary differs from a glossary, which is a simple vocabulary consisting of a list of words and definitions.
URI Base	A base **URI** in a domain owned by the organization that maintains the model or ontology. SOURCE: ISO 19150-2 (Clause 6.2.2).
Uniform Resource Identifier (URI)	A compact string of characters for identifying an abstract or physical resource. NOTE1: A resource can be anything that has identity, *e.g.*, an OWL class instance and its associated annotations. NOTE2: A URI identifies a resource either by location, or by name, or both. NOTE3: URIs are limited to a subset of the ASCII character set. SOURCE: IETF RFC 3986
Uniform Resource Locator (URL)	A compact string representation for location and access of a resource available on the internet. NOTE: A URL is a type of **URI**. SOURCE: IETF RFC 1738

Term	Definition
vocabulary term	A defined **lexical item** that represents a **concept** that describes real-world phenomena. NOTE1: A vocabulary term may represent either: (1) a simple concept that characterizes one type or one aspect of real-world phenomena (**basic vocabulary term**); or (2) a complex concept that characterizes a domain of related types or values that may be used to describe real-world phenomena (**complex vocabulary term**). For example, a complex vocabulary term may represent the color-value domain consisting of the set of visible-light color values applicable to appearances of real-world phenomena, while each individual color value is represented by a basic term. NOTE2: Additional optional information may also be specified for a vocabulary term, such as additional lexical items that may be used as alternative labels (synonyms) for the concept.

4.2 Acronyms

The acronyms that are used in this standard are specified in the following list.

ASCII American Standard Code for Information Interchange
ATC Abstract Test Case
ATM Abstract Test Module
ATS Abstract Test Suite
API Application Programming Interface
BCP Best Current Practice
CV Controlled Vocabulary
DCMI Dublin Core Metadata Initiative
DoD (U.S.) Department of Defense
GCSB GEOINT Content Standards Board
GEOINT Geospatial Intelligence
IANA Internet Assigned Numbers Authority
IC (U.S.) Intelligence Community
ICS Implementation Conformance Statement
IEC International Electrotechnical Commission
IETF Internet Engineering Task Force
IRI Internationalized Resource Identifier
ISO International Organization for Standardization
NCV NSG Core Vocabulary
NCVX NSG Vocabulary Auxiliary Ontology
NEV NSG Enterprise Vocabulary
NGA National Geospatial-Intelligence Agency
NSG National System for Geospatial Intelligence
OWL Web Ontology Language
RDF Resource Description Language
RDFS RDF Schema
REGX NSG Register Auxiliary Ontology
REST REpresentational State Transfer
SDO Standards Development Organization
SKOS Simple Knowledge Organization System
UML Unified Modeling Language
URI Uniform Resource Identifier
URL Uniform Resource Locator
W3C World Wide Web Consortium
XML Extensible Markup Language

4.3 Presentation Font

The general text of this document is presented using Arial font. Encoding elements are presented using Courier New font (*e.g.*, `ncvx:VocabularyTerm`).

5 NSG Vocabulary Specification

5.1 Introduction

The NSG Core Vocabulary (NCV) Standard ("NCV Standard") establishes the terminological, semantic, and structural basis for specifying a controlled vocabulary of terms intended for use in the NSG community to consistently and unambiguously describe the content of Geospatial Intelligence (GEOINT) information.

A controlled vocabulary consists of a set of formally specified vocabulary terms. Each vocabulary term is a defined lexical item (*i.e.*, a word, phrase, or abbreviation in a specified natural language) that represents a concept in the context or community which uses the vocabulary. Additional information about a vocabulary term may be included, such as alternative lexical items that are synonyms for the term. Metadata for indicating the status of a term within the controlled vocabulary is also included in the vocabulary specification.

The formal representation for an NSG vocabulary is based on the Simple Knowledge Organization System (SKOS) Recommendation from the World Wide Web Consortium (W3C). This SKOS-based representation supports the use of NSG terminology to describe data exchanged among automated information systems on the Semantic Web in a machine-processable way. To support usage on the Web, the NCV Standard prescribes Internationalized Resource Identifiers (IRIs) to identify the component terms of the NCV content. The NCV Standard specifies two W3C encodings for vocabulary content, in order to support applications that require a Web encoding format.

This vocabulary specification defines the NSG vocabulary information model and specifies the two authorized W3C encodings for NSG vocabulary content. The vocabulary specification supports NSG vocabularies in three ways, by providing:

1. Content specification – the information model for NSG vocabulary terms;
2. Content identification – IRIs for unique identification of NSG vocabulary components; and
3. Content encoding – Specifications for the RDF/XML and N-Triples encodings of NSG vocabularies.

Section 5.3 specifies the information model for an NSG vocabulary in a diagram together with a tabular specification of all included modeling elements.

Section 5.4 specifies the use of the W3C representation language SKOS to represent elements of the NSG vocabulary information model.

Section 5.5 specifies the implementation of an NSG vocabulary in two supported encodings: (1) RDF/XML; and (2) N-Triples. These encodings support linking concepts in an NSG vocabulary to instance data in either RDF/XML or N-Triples formats, in order to describe data exchanged among automated information systems. These encodings also support mapping NSG terminology to other formally encoded vocabularies.

The content of the NSG Core Vocabulary ("NCV content") is published in the NCV Register and in the NSG-unique Standards Register of the NSG Standards Registry. Individual vocabulary terms may be examined online in the NCV Register. The technical artifacts containing the authorized encodings of the NCV content (in RDF/XML and N-Triples) are published in the NSG-unique Standards Register of the NSG Standards Registry. Web-enabled resources for individual vocabulary terms are accessible through the REST API component of the NSG Standards Registry.

5.2 The Semantic Triangle: Terms, Concepts, and Referents

A vocabulary term is a lexical item (that is, a word, abbreviation, or multi-word phrase) in a natural language. The term represents a concept that is the meaning signified by the term. The meaning is applicable to some real-world phenomena (or possible phenomena).

When a linguistically competent user encounters a word in a known language, the user understands the concept that the word represents. This is the *meaning* represented, or "signified", by the word. The user has a mental model of the idea or object that the word signifies.

The meaning of a term is a concept that enables a user to apply the term to real-world phenomena. A term must be interpreted by a user in order to use it to describe a real-world entity (the *referent* of the word). The interpretation of a term based on its conceptual meaning is originally based in human understanding and linguistic behavior.

Figure 1 shows the triangular relationship of vocabulary terms (lexical items) to concepts in the mind of a language user and ultimately to descriptions of the world of phenomena (or of a possible or projected state of the world). Terms represent concepts in the mind of a language user. Language users make use of their conceptual understanding when they relate terms to real-world entities.

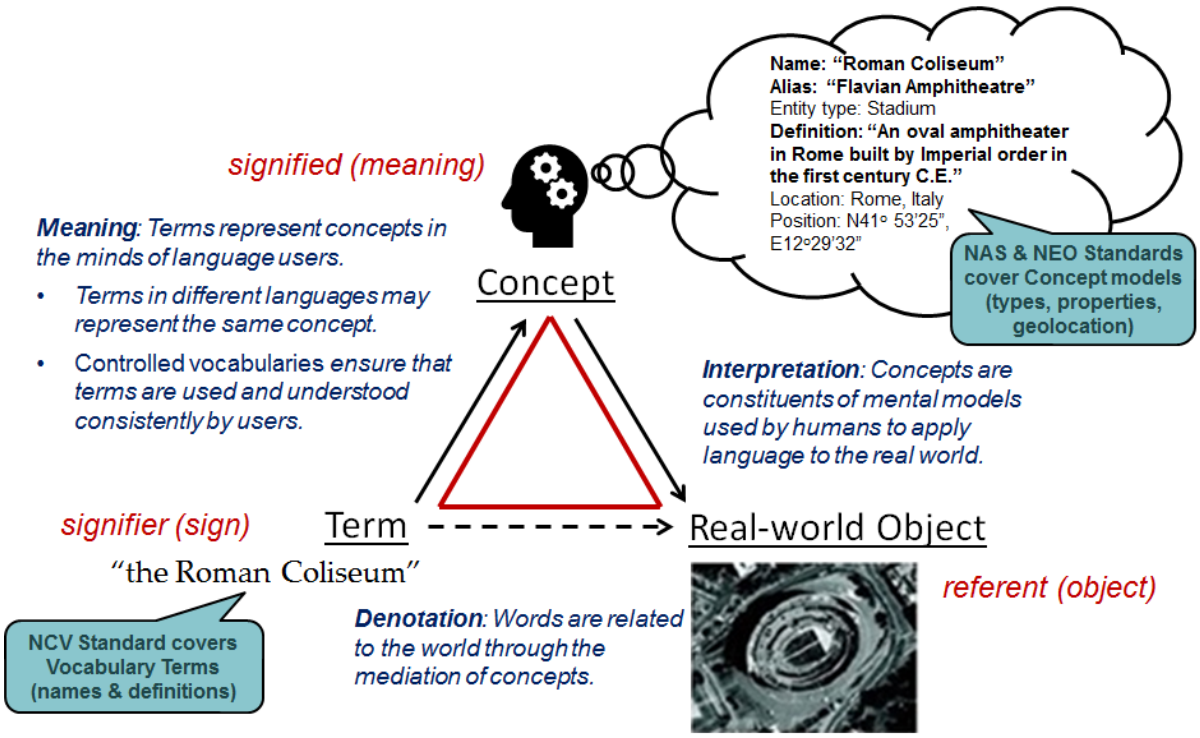


Figure 1 – The Semantic Triangle[5]

Semantic information technologies offer ways to formalize terminology in machine-processable formats. One purpose of creating Web-enabled encodings for a controlled vocabulary is to use machine processing of vocabulary terms to improve data understanding by providing a standardized, accessible terminology for use in understanding data in a domain. Machine-processable terminology can also be used to improve data management (including the labeling, indexing, searching, and linking of data). Finally, machine processing of controlled vocabularies allows the automated distribution and serving of a standard terminology, and the ability to share, discover, and relate terminologies among communities.

5.3 NSG Vocabulary Information Model

5.3.1 Introduction

The information model for a conformant NSG vocabulary defines the modeling concepts needed to represent a controlled vocabulary of terms used for the description of geospatial data in the NSG. The model specifies a set of properties to record the semantics, provenance, and status of individual vocabulary terms.

The NSG vocabulary information model comprises the following information modeling constructs:

- the abstract class of vocabulary terms;
- two abstract subclasses that distinguish basic vocabulary terms from complex vocabulary terms;
- three subclasses of basic vocabulary term;
- two subclasses of complex vocabulary term; and
- one class representing an axiom for asserting that two or more vocabulary terms are different from one another,

together with attributes and associations (relations) between classes.

[5] Diagram derived from ISO/TC 211 19150-1 *Geographic information – Ontology – Part 1: Framework*, Figure B.1, p. 18.

The information model supports the specification of individual vocabulary terms including their designation and definition. It also supports the assertion of relationships between vocabulary terms (*e.g.*, broader or narrower), which can be used to specify a structured vocabulary.

Section 5.3.2 specifies the modeling elements of the NSG vocabulary information model in the form of a diagram (Figure 2).

Sections 5.3.3 and 5.3.4 contain a tabular specification of the main modeling concepts used by the model.

Section 5.3.6 specifies the datatypes used by the model.

5.3.2 Vocabulary Information Model Diagram

The NSG vocabulary information model is presented diagrammatically in Figure 2.[6] A description of the model elements in tabular format follows the diagram.

Each main element of the NSG vocabulary information model is defined in tables in the next two sections. The table format used to document individual elements is as follows:

- The **Reference** column consists of a sequentially-assigned, non-normative identifier of the element (class or property) that is provided for cross-referencing purposes. It may vary from version-to-version of this document.
- The **NSG Vocabulary Modeling Concept** column specifies the class name, class attribute name, or class role name of the information modeling concept. The names of abstract classes are italicized. Role names are prefixed by the italicized phrase "*Role name*".
    - A specified class in the model has a capitalized name and always appears in the table on a grey-highlighted row above its properties.
    - The properties (attributes and/or association roles) of a model class are specified in subsequent rows of the table below the class row.
- The **Definition** column specifies the definition of the model class or property.
- The **Source of Definition** column records the source of the definition of the information modeling concept, if other than the NCV Standard.
- The **Obligation** column specifies if the property is **Mandatory**, Conditional, or *Optional*.
    - Properties whose obligation is "**Mandatory**" shall be populated in accordance with the property definition and any associated guidance.
    - Properties whose obligation is "Conditional" are mandatory when the stated condition is satisfied, in which case they shall be populated in accordance with the property definition and any associated guidance.
    - Properties whose obligation is "*Optional*" are optional, but their population is good business practice when the applicable information is available.
- The **Multiplicity** column indicates the number of instances of the value type of the property that are permitted by this information model. In the case that more than a single domain value of the property is allowed, an indication may also be included in this column if the ordering of the domain values is significant.
- The **Value Type** column indicates the modeling concept or datatype that is used to define the value(s) of the property.

[6] See Annex F for an explanation of the notation.

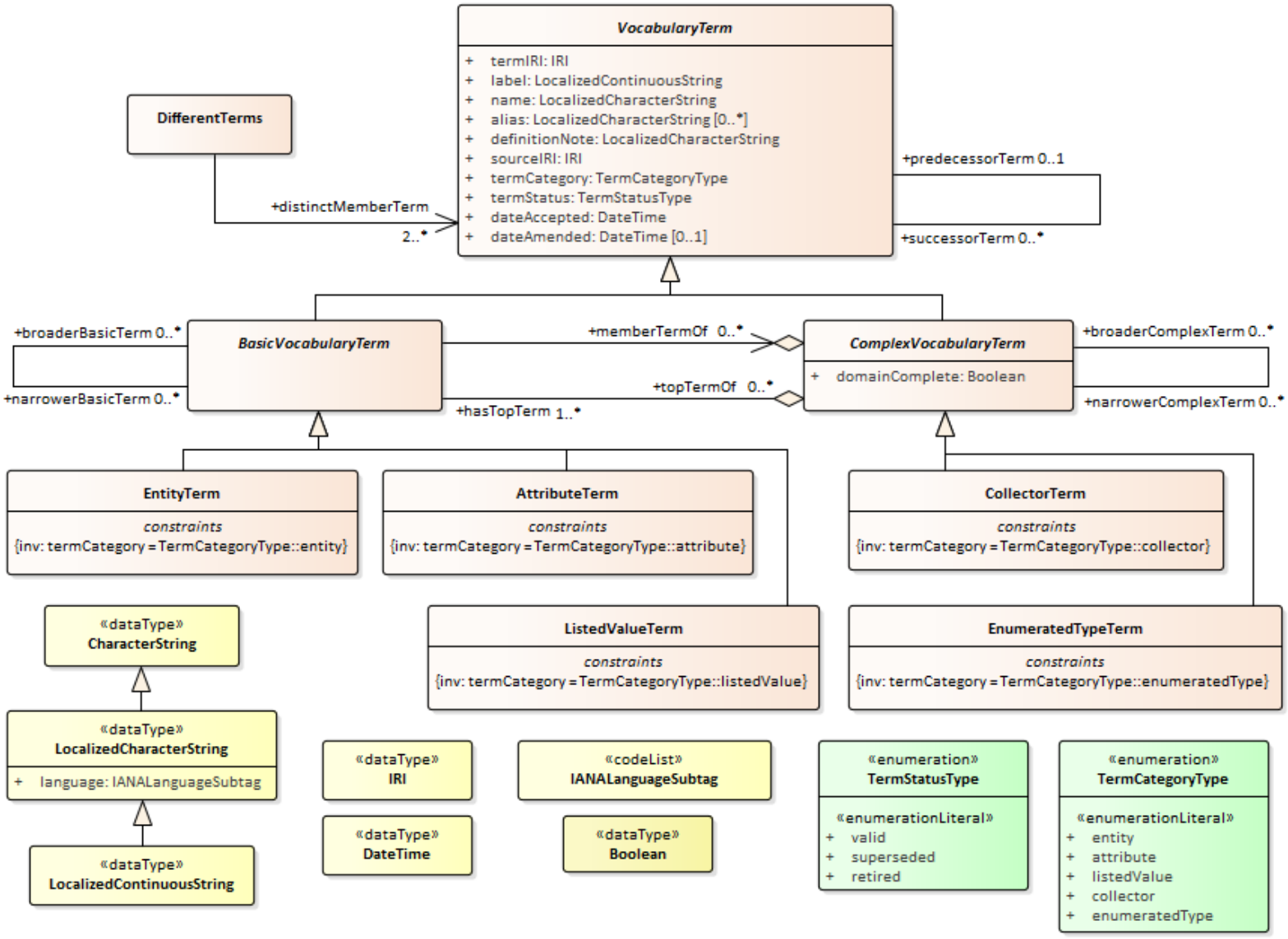


Figure 2 – Overview of the NSG Vocabulary Information Model

5.3.3 *VocabularyTerm* and its Abstract Subclasses (*BasicVocabularyTerm* and *ComplexVocabularyTerm*)

The fundamental element of the NSG vocabulary information model is the abstract class *VocabularyTerm*, which is defined in Table 4. This class is partitioned by two abstract subclasses, *BasicVocabularyTerm* and *ComplexVocabularyTerm*, which are defined in Table 5 and Table 6, respectively.

Table 4 – *VocabularyTerm {Abstract}* and its Properties

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
1	*VocabularyTerm {Abstract}*	A defined lexical item (*i.e.,* a word, phrase, or abbreviation in a specified natural language) which represents a concept that describes real-world phenomena denoted by that lexical item. NOTE: Additional optional information may also be specified, such as additional lexical items that may be used as alternative labels (synonyms) for the concept.				
2	termIRI	A uniform resource identifier (URI) that uniquely identifies a vocabulary term, consisting of a URI base owned by the organization that maintains the vocabulary, concatenated (following a separator "/") with an identifier for the vocabulary (for example: "ncv"), optionally concatenated (following a separator "/") with the version number of the resource, concatenated (following a separator, either "/" or "#") with the label of the vocabulary term. EXAMPLE: http://api.nsgreg.nga.mil/vocabulary/ncv/MineShaftSuperstructure	IETF RFC 3987, *Internationalized Resource Identifiers (IRIs);* IETF RFC 3986, *Uniform Resource Identifiers (URI): Generic Syntax*.	**Mandatory**	Exactly one	IRI
3	label	A human-readable but compressed (*i.e.*, no white spaces) identifier for a vocabulary term that is unique within a vocabulary. NOTE: The label may be used as the terminal segment of the IRI for the vocabulary term. EXAMPLE: The label 'AccessZone' as used in the IRI for the vocabulary term 'http://api.nsgreg.nga.mil/vocabulary/ncv/AccessZone'.	Based on ISO 19135-1:2015, 7.5.2 itemIdentifier	**Mandatory**	Exactly one	LocalizedContinuousString
4	name	The preferred human-readable lexical item (*i.e.*, word, phrase, or abbreviation) that is used to represent a concept in a specified language. EXAMPLE: "Railway Yard"	ISO 19135-1:2015, B.2.3.2 (RE_RegisterItem attribute) name	**Mandatory**	Exactly one	LocalizedCharacterString
5	alias	A functionally equivalent synonym for representing a concept in an alternative context or language. EXAMPLE: The term "Mine Shaft Superstructure" has synonyms "Mine Shaft Headgear" and "Pit-head Frame".	ISO 19109:2015, 7.4.4 designation	*Optional*	Zero or more	LocalizedCharacterString

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
6	definitionNote	A precise statement of the nature and normative properties of a concept (definition), followed by an optional statement (description) about relevant non-essential qualities, variations, scope, and/or examples of the concept. NOTE: For a concept representing an attribute, the value type and (if applicable) physical quantity for possible attribute values may be indicated. EXAMPLE: The definitionNote of the term labeled "Horizontal Clearance" is: "Definition: The distance available to pass a load that extends laterally beyond the wheels of a vehicle. Description: [None Specified] Value Type: Real Interval: Non-negative. Physical Quantity: Length."	ISO 19135-1:2015, B.2.3.2 definition	**Mandatory**	Exactly one	LocalizedCharacterString
7	sourceIRI	The Internationalized Resource Identifier (IRI) for the resource that provides the provenance for the vocabulary term.	ISO 19115-1:2014, Table B.5.2 (row 136), sourceCitation	**Mandatory**	Exactly one	IRI
8	termCategory	The type of a vocabulary term, indicating whether the term represents a concept that describes an entity, an attribute, a listed value (in a value domain), a value domain (of listed values), or a subject domain (of entity and/or attribute types).		**Mandatory**	Exactly one	<<enumeration>> TermCategoryType (Section 5.3.6.8)
9	termStatus	The standing of a vocabulary term with respect to inclusion in a managed resource. NOTE: A vocabulary term may have a status of accepted (Valid), replaced (Superseded), or removed (Retired). Term status values are mutually exclusive, and a term should have only one status at a specific date-time. EXAMPLE: A vocabulary term may be accepted into a controlled vocabulary on a specific date, making it a Valid term in the vocabulary resource; later, its status may be changed to Retired if the community decides the term should no longer be used.	ISO 19135-1:2015, 7.5.2 status	**Mandatory**	Exactly one	<<enumeration>> TermStatusType (Section 5.3.6.9)
10	dateAccepted	The date and (optionally) time on which an approved vocabulary term was initially included in a managed resource. EXAMPLES: (1) The date on which a term is accepted into a vocabulary, such as the NSG Core Vocabulary. (2) The date on which a name is added to the NGA Geographic Names Database.	ISO 19135-1:2015, B.2.3.2	**Mandatory**	Exactly one	DateTime

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
11	dateAmended	The date and (optionally) time on which an approved vocabulary term was superseded or retired in a managed resource. The date amended will always be later than the date accepted. EXAMPLES: (1) The date on which a term in a controlled vocabulary, such as the NSG Core Vocabulary, is superseded (that is, replaced) by another vocabulary term. (2) The date on which a name is retired (that is, removed) from the NGA Geographic Names Database.	ISO 19135-1:2015, B.2.3.2	Conditional (mandatory if the term has a *termStatus* of 'superseded' or 'retired')	If applicable, then exactly one.	DateTime
12	*Role name:* predecessorTerm	A vocabulary term that was replaced by this vocabulary term.	ISO 19126:2009, 6.4.1 predecessor; ISO 19135-1:2015, 7.5.2 predecessor	Conditional (mandatory if the term has superseded another term(s))	If applicable, then exactly one.	*VocabularyTerm {Abstract}*
13	*Role name:* successorTerm	A vocabulary term that replaced this vocabulary term.	ISO 19126:2009, 6.4.1 successor; ISO 19135-1:2015, 7.5.2 successor	Conditional (mandatory if the term has been superseded by another term(s))	If applicable, then one or more.	*VocabularyTerm {Abstract}*

Table 5 – *BasicVocabularyTerm {Abstract}* and its Properties

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
1	*BasicVocabularyTerm {Abstract}*	A vocabulary term that represents a concept of a single type, aspect, relationship, or value that is used to describe real-world phenomena. NOTE: A basic term may be used to denote a type of entity, an attribute, or a possible value (in a value domain). EXAMPLES: “Body of Water” (entity), “Depth” (attribute), “Physical Condition Term Set” (value domain), “Damaged” (value), “Linguistic Entities” (subject domain).				Subclass of *VocabularyTerm {Abstract}*
2	*Role name:* broaderBasicTerm	A basic vocabulary term that is more general in meaning than this basic vocabulary term.		Conditional (mandatory if the term is a *memberTermOf* an EnumeratedTypeTerm but is **not** also a *topTermOf* that same EnumeratedTypeTerm)	If applicable, then one or more.	*BasicVocabularyTerm {Abstract}*
3	*Role name:* narrowerBasicTerm	One or more basic vocabulary term(s) that are more specialized in meaning than this basic vocabulary term.		Conditional (mandatory if the term is a *broaderBasicTerm* for another term)	If applicable, then one or more.	*BasicVocabularyTerm {Abstract}*
4	*Role name:* memberTermOf	The complex vocabulary term representing the subject or value domain to which this basic vocabulary term belongs.		Conditional (mandatory if the term has the *termCategory* value = ‘listedValue’; optional otherwise)	If applicable, then exactly one.	*ComplexVocabularyTerm {Abstract}*
5	*Role name:* topTermOf	The complex vocabulary term representing the subject or value domain to which this basic vocabulary term belongs and which contains no generalization of this term.		Conditional (mandatory if the term has the *termCategory* value = ‘listedValue’; optional otherwise)	If applicable, then exactly one.	*ComplexVocabularyTerm {Abstract}*
Constraints						
1) Basic vocabulary terms related by broaderBasicTerm shall have the same termCategory value. 2) Basic vocabulary terms related by narrowerBasicTerm shall have the same termCategory value.						

Table 6 – *ComplexVocabularyTerm {Abstract}* and its Properties

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
1	*ComplexVocabularyTerm {Abstract}*	A vocabulary term that represents a concept that describes a domain of related types or values that may be used to describe real-world phenomena. NOTE: A complex vocabulary term may be used to denote a subject domain (of entity and/or attribute types) or a value domain (of possible attribute values). Specific types or values in the domain are denoted by basic vocabulary terms. EXAMPLES: (*Subject domain*) "Physical Quantity Terms", a collection of terms each member of which denotes a property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed by means of a number and a reference. (*Value domain*) "Visible Light Type", a color-value domain consisting of a set of possible color values applicable to appearances of real-world phenomena.				Subclass of *VocabularyTerm {Abstract}*
2	domainComplete	An indicator as to whether the set of basic vocabulary terms belonging to the domain denoted by a complex vocabulary term includes all the possible members of that domain, with TRUE meaning 'complete' and FALSE meaning 'not complete'.	ISO 19103:2015, 6.5.1 Enumerations and codelists – General rules	Conditional (mandatory if the term has the *termCategory* value = 'listedValue'; optional otherwise)	Exactly one	Boolean
3	*Role name:* hasTopTerm	A basic vocabulary term that belongs to the type (subject or value domain) represented by this complex vocabulary term and which is not a specialization of another term in that domain.		**Mandatory**	One or more	*BasicVocabularyTerm {Abstract}*
4	*Role name:* broaderComplexTerm	A complex vocabulary term that is more general in meaning than this complex vocabulary term.		Conditional (mandatory if the term is a *narrowerComplexTerm* for another term)	If applicable, then one or more.	*ComplexVocabularyTerm {Abstract}*
5	*Role name:* narrowerComplexTerm	One or more complex vocabulary term(s) that are more specialized in meaning than this complex vocabulary term.		Conditional (mandatory if the term is a *broaderComplexTerm* for another term)	If applicable, then one or more.	*ComplexVocabularyTerm {Abstract}*

Constraints
1) For every ComplexVocabularyTerm, there shall be at least one BasicVocabularyTerm that is a member of that ComplexVocabularyTerm.
2) Each ComplexVocabularyTerm shall have all of its member vocabulary terms declared as pairwise distinct.
3) ComplexVocabularyTerms related by broaderComplexTerm shall have the same termCategory value.
4) ComplexVocabularyTerms related by narrowerComplexTerm shall have the same termCategory value.

5.3.4 Concrete Subclasses of *BasicVocabularyTerm* and *ComplexVocabularyTerm*

Each vocabulary term in an NSG vocabulary is declared to belong to one of the concrete subclasses of either *BasicVocabularyTerm* or *ComplexVocabularyTerm*. *BasicVocabularyTerm* has three subclasses, EntityTerm, AttributeTerm, and ListedValueTerm, which are defined in the next three tables below. *ComplexVocabularyTerm* has two subclasses, CollectorTerm and EnumeratedTypeTerm, which are defined in Table 10 and Table 11, respectively.

All of these concrete subclasses inherit the attribution and constraints from the applicable superclass (*BasicVocabularyTerm* (Table 5) or *ComplexVocabularyTerm* (Table 6)), as well as from *VocabularyTerm* (Table 4).

Table 7 – EntityTerm and its Properties

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
1	EntityTerm	A basic vocabulary term that represents a concept of an entity type. NOTE: An entity type is an abstraction that characterizes real-world phenomena. EXAMPLES: “Person”, “Building”, “Event”, “Administrative Boundary”, “Resource Right”.	ISO 19126:2009, 4.1.11, feature concept (generalized)			Subclass of *BasicVocabularyTerm {Abstract}*

Constraints
1) The termCategory attribute value of an EntityTerm shall equal ‘entity’.
2) An EntityTerm shall be a member term of only a CollectorTerm(s).
3) An EntityTerm shall be a top term of only a CollectorTerm(s).

Table 8 – AttributeTerm and its Properties

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
1	AttributeTerm	A basic vocabulary term that represents a concept that describes a property of an entity. NOTE1: A property (also known as an attribute) will have a specific value in relation to a particular entity. NOTE2: The definitionNote for an AttributeTerm will specify the value type and (if applicable) the physical quantity for the value of the property represented by the AttributeTerm. EXAMPLES: "Length" (for a physical object, with a value in physical distance); “Color” (for a physical object, with a specified value either in a qualitative color range, or in a wavelength of light); “Principal Activity” (for an organization, with an activity type as value).	ISO 19126:2009, 4.1.9, feature attribute concept (generalized)			Subclass of *BasicVocabularyTerm {Abstract}*
Constraints						
1) The termCategory attribute value of an AttributeTerm must equal ‘attribute’. 2) An AttributeTerm shall be a member term of only a CollectorTerm(s). 3) An AttributeTerm shall be a top term of only a CollectorTerm(s).						

Table 9 – ListedValueTerm and its Properties

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
1	ListedValueTerm	A basic vocabulary term that represents a concept that characterizes one value in a domain set of possible values for a property of an entity. EXAMPLES: “Intact”, “Damaged”, “Destroyed”, “Dismantled”, “Unmaintained”, or “Construction” (to characterize the condition of a physical object).	ISO 19103:2015, 4.1.15 (value domain); ISO 19103:2015, 6.5.1 Enumerations and codelists – General rules			Subclass of *BasicVocabularyTerm {Abstract}*
Constraints						
1) The termCategory attribute value of a ListedValueTerm must equal ‘listedValue’. 2) Every ListedValueTerm shall be a member of exactly one EnumeratedTypeTerm. 3) A ListedValueTerm shall be a member term of only an EnumeratedTypeTerm. 4) A ListedValueTerm shall be a top term of only an EnumeratedTypeTerm.						

Table 10 – CollectorTerm and its Properties

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
1	CollectorTerm	A complex vocabulary term that represents a concept of a subject domain having a specialized set of terms for entity and/or attribute types used to describe real-world phenomena. EXAMPLE: The CollectorTerm “Coordinate System Terms” includes the vocabulary terms “Cartesian 2D”, “Cartesian 3D”, “Geodetic Ellipsoidal”, and other terms that denote mathematical rules for assigning coordinates to points. EXAMPLES: Quality Measure Terms, Belief System Terms, Coordinate System Terms.	ISO 19126:2009, 6.2.2 (scope)			Subclass of *ComplexVocabularyTerm {Abstract}*
Constraints						
1) The termCategory attribute value of a CollectorTerm shall equal ‘collector’. 2) Every member term of a CollectorTerm shall have the value of termCategory equal to either ‘entity’ or ‘attribute’.						

Table 11 – EnumeratedTypeTerm and its Properties

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
1	EnumeratedTypeTerm	A complex vocabulary term that represents the concept of a specific domain of values for describing a characteristic of an entity. NOTE: An EnumeratedTypeTerm represents a value domain whose individual values are represented by basic vocabulary terms called ListedValueTerms, which together represent the set of possible values in that value domain. EXAMPLE: The enumerated type for biological sex comprises the values “Male” and “Female”.	ISO 19126:2009, 4.1.22 (value domain); ISO 19103:2015, 4.1.15 (value domain); 19103:2015, 6.5.1 Enumerations and codelists – General rules			Subclass of *ComplexVocabularyTerm {Abstract}*
Constraints						
1) The termCategory value of an EnumeratedTypeTerm shall equal ‘enumeratedType’. 2) Every member term of an EnumeratedTypeTerm shall have the termCategory value equal to ‘listedValue’.						

5.3.5 Term Distinctness: DifferentTerms

The modeling class DifferentTerms is used to declare the pairwise distinctness of all individual terms that are members of the class. Distinct terms have non-equal identifiers (IRIs), distinct names, and different definitions. Distinct terms may overlap in meaning (for example, a narrower term with its broader term) but may not be identical in meaning.

Table 12 – DifferentTerms and its Properties

Ref #	NSG Vocabulary Modeling Concept	Definition	Source of Definition	Obligation	Multiplicity	Value Type
1	DifferentTerms	A collection of basic vocabulary terms that are mutually distinct; that is, no term in the collection has the same meaning as any of the others.				
2	*Role name:* distinctMemberTerm	A vocabulary term belonging to this collection of vocabulary terms that represent concepts that are different from each other.		**Mandatory**	Two or more	*VocabularyTerm {Abstract}*
Constraints						
1) Each vocabulary term in a DifferentTerms collection shall have its IRI distinct from the IRI of every other vocabulary term in that DifferentTerms collection. 2) Each vocabulary term in a DifferentTerms collection shall have its name distinct from the name of every other vocabulary term in that DifferentTerms collection. 3) Each vocabulary term in a DifferentTerms collection shall have its definition (definitionNote) distinct from the definition of every other vocabulary term in that DifferentTerms collection.						

5.3.6 Datatypes in the NSG Vocabulary Information Model

The NSG Vocabulary Information Model includes the following datatypes which are specified as value types for properties in the information model.

5.3.6.1 IRI

The IRI datatype represents Internationalized Resource Identifiers (IRIs). An IRI is a finite-length sequence of characters from the Universal Character Set (Unicode/ISO 10646) that is intended to identify an abstract or physical resource as described in IETF RFC 3987. The value may be absolute or relative, and it may have an optional fragment identifier (that is, it may be an IRI Reference).

5.3.6.2 DateTime

The datatype DateTime represents the set of specialized character strings consisting of digits with leading zeroes that contain values for century (CC), year (YY), month (MM), day (DD), and hours (hh), minutes (mm), and seconds (ss), with a timezone offset from Coordinated Universal Time (UTC) or 'Z' for UTC, formatted in accordance with IETF RFC 3339, which is 'CCYY-MM-DDThh:mm:ssZ' (for example: '1985-04-12T11:45:20Z' for 11 hours, 45 minutes and 20 seconds UTC on 12 April 1985). The format conforms to `xsd:dateTime`[7]. Midnight is understood to be 00:00:00 (the beginning of a day); when the time is not specified then midnight in the local time zone is typically implied. Time may optionally be unspecified with zero-values.

5.3.6.3 IANALanguageSubtag

The IANALanguageSubtag codelist represents a set of formal identifiers for natural languages, as defined by BCP 47 (currently represented by RFC 4646 and RFC 4647) or its successor(s). IANALanguageSubtag values are the lowercase two-character codes contained in the Language Subtag registry administered by the Internet Assigned Numbers Authority (IANA) in accordance with the Internet Engineering Task Force (IETF) Recommendation for Comment (RFC) 5646.[8] The language codes in the IANA Language Subtag registry are based on the International Organization for Standardization (ISO) 639 series of standards.

5.3.6.4 Boolean

The Boolean datatype represents the values of two-valued logic. A Boolean value is either TRUE or FALSE.

5.3.6.5 CharacterString

The CharacterString datatype represents a finite-length sequence of zero or more characters from the Universal Character Set (Unicode), as specified by ISO/IEC 10646. The character string may be accompanied by a formal identifier (*i.e.*, a language code or token) used to identify the natural language of the expression represented by the character string. A character string may be further specified, including with respect to length (exact, minimum, or maximum) or pattern (for example, a pattern that excludes space characters).

5.3.6.6 LocalizedCharacterString

The LocalizedCharacterString datatype represents a character string for which the natural language to use in interpreting the content is specified by a formal identifier (a language code or token), as defined in Table 13. A character string is a finite-length sequence of zero or more characters from the Universal Character Set (Unicode). A language tag is a lowercase abbreviation for the natural language of the expression represented by a character string. The LocalizedCharacterString datatype is a subclass of the CharacterString datatype.

[7] See http://www.w3.org/TR/xmlschema-2/#dateTime.
[8] The complete registry content is available at the following URL: http://www.iana.org/assignments/language-subtag-registry/language-subtag-registry.

Table 13 – <<dataType>> LocalizedCharacterString and its Properties

Ref #	NSG Vocabulary Modeling Concept	Definition	Obligation	Multiplicity	Value Type
1	LocalizedCharacterString	A character string for which the natural language to use in interpreting the content is specified by a formal identifier (a language code or token).			Subclass of <<dataType>> CharacterString
2	language	The natural language to be used for interpreting the content of a character string, as indicated by a formal identifier (a code) conformant with BCP 47. NOTE: Two-character lowercase language abbreviations based on IETF RFC 5646 codes (for example: 'en' for English) are specified for maximum interoperability.	**Mandatory**	Exactly one	<<codeList>> IANALanguageSubtag

5.3.6.7 LocalizedContinuousString

The LocalizedContinuousString datatype represents a character string having no whitespace characters (such as linefeeds, carriage returns, or spaces, except for spaces encoded by '%20') and for which the natural language to use in interpreting the content is specified by a formal identifier (a language code or token) using the property inherited from LocalizedCharacterString, defined in Table 13 (row 2). The LocalizedContinuousString datatype is a subclass of the LocalizedCharacterString datatype.

5.3.6.8 TermCategoryType

The enumeration TermCategoryType and its domain values are presented in the UML model in Figure 2. The domain values are defined in Table 14. The enumeration TermCategoryType represents the set of coded domain values that specify the kind of concept represented by a particular vocabulary term. For example, a vocabulary term may denote an object (entity), a property (attribute), a possible value (listedValue), a value domain (enumeratedType), or a subject domain (collector). The categories are defined in the table below. Term categories are mutually exclusive.

Table 14 – Domain Values for <<enumeration>> TermCategoryType

Ref #	Name	Definition
1	entity	The term represents a concept that describes a type of real-world phenomenon. NOTE: An entity type is an abstraction that characterizes real-world phenomena. EXAMPLES: "Bridge", "Person", "Mountain", "Event".
2	attribute	The term represents a concept that describes a characteristic of an entity. NOTE: A characteristic will have a specific value in relation to a particular entity. EXAMPLES: (1) "Length" (for a physical object, with a value in physical distance); (2) "Color" (for a physical object, with a specified value either in a qualitative color range, or in a wavelength of light); (3) "Principal Activity" (for an organization, with an activity type as value).
3	listedValue	The term represents a concept that describes a value from an enumerated type. EXAMPLES: "Intact", "Damaged", "Destroyed", "Dismantled", "Unmaintained", or "Construction" (to characterize the condition of a physical object).
4	collector	The term represents a concept of a subject domain that describes a set of specialized vocabulary terms. NOTE: A CollectorTerm groups basic vocabulary terms that are used to describe a specific subject domain. EXAMPLES: Quality Measures, Coordinate Reference Systems, and Belief Systems.
5	enumeratedType	The term represents a concept that describes a value domain consisting of a set of possible values for a property of an entity. NOTE: An EnumeratedTypeTerm groups basic vocabulary terms (called ListedValueTerms) that represent the individual values. EXAMPLE: The enumerated type for biological sex comprises the values "Male" and "Female".

5.3.6.9 TermStatusType

The UML model for the enumeration TermStatusType and its domain values is presented in Figure 2. The domain values are defined in Table 15. The enumeration TermStatusType represents the set of coded domain values used to describe the standing of a vocabulary term with respect to its inclusion in a controlled vocabulary, which is a managed resource. A vocabulary term may have a status of accepted (Valid), replaced (Superseded), or removed (Retired). For example, a vocabulary term may be accepted into a controlled vocabulary on a particular date, making it a Valid term in the vocabulary resource; later, its status may be changed to Retired if the community decides the term should no longer be used. The statuses are mutually exclusive, and a vocabulary term may have only one status at a time. Source: ISO 19135-1:2015, 7.5.2 RE_ItemStatus (limited to the values 'valid', 'superseded', and 'retired').

Table 15 – Domain Values for <<enumeration>> TermStatusType

Ref #	Name	Definition
1	valid	The item has been accepted, is recommended for use, and has not been superseded or retired.
2	superseded	The item has been replaced by another item and is no longer recommended for use.
3	retired	The item is no longer recommended for use, and it has not been superseded by another item.

5.4 NSG Vocabulary Representation using Semantic Web Languages

5.4.1 Introduction

The information modeling elements of the NSG vocabulary information model can be represented using the Simple Knowledge Organization System (SKOS) defined by W3C Recommendations for the Semantic Web. The use of SKOS enables the encoding of NSG vocabulary concepts in machine-readable formats that can be used with Web-based applications and shared on the Web to provide a machine-processable vocabulary for data published and/or discovered from multiple sources (for example, as Linked Data).[9]

The Semantic Web is a virtual set of distributed data accessible on the internet that is represented using standards-based, machine-processable descriptions that allow the data to be application-independent and available for re-use in accordance with a framework of common standards.[10] Data in the Semantic Web can be discovered, queried, aggregated, and analyzed as part of the larger information ecosystem by leveraging the semantics (*i.e.*, meanings) of the data. The phrase "the Web of Data" is used synonymously with the Semantic Web in this sense.[11]

The term "Semantic Web" also encompasses the technologies, including the standards and operational infrastructure, that support the creation of the Web of Data. Semantic Web standards define a framework (including representation languages and exchange formats) for describing data in a reusable, machine-processable way, as well as guidelines for creating the operational environment on the Web.[12] Finally, the Semantic Web relies on an implemented technology infrastructure that enables the real-time publication, linking, and processing of data published in Semantic Web exchange formats.

The set of standards used to enable sharing of the semantics of information on the Web is often referred to as the "Semantic Web Stack", because later recommendations built upon and extended the capabilities of earlier standards. Figure 3 shows graphically the reliance on and dependencies among the recommendations and standards that are used together to enable the Semantic Web. Contributions of different layers of the stack are explained below.

[9] A similar approach to data definition and data linking may be used in a closed networked system, rather than on the open internet, when required for mission-specific purposes.
[10] *The Semantic Web*. Michael C. Daconta, Leo J. Obrst, and Kevin T. Smith. Wiley Publishing, Inc. 2003. Page 4.
[11] Linked Data Glossary, W3C Working Group Note 27 June 2013 (http://www.w3.org/TR/ld-glossary/)
[12] "The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries." (W3C FAQ, *What is the Semantic Web*: http://www.w3.org/2001/sw/SW-FAQ)

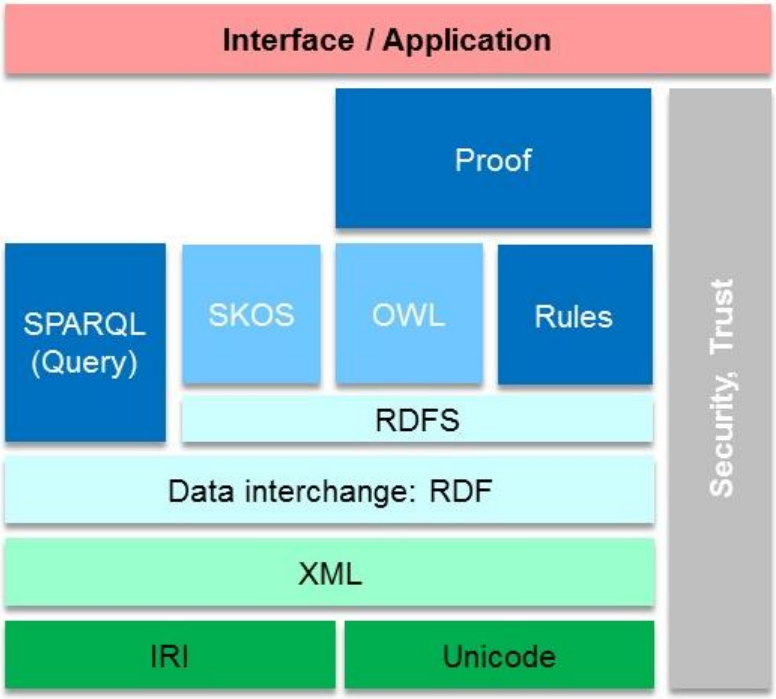


Figure 3 – SKOS in the Semantic Web Stack[13]

The World Wide Web Consortium (W3C) has developed a core set of recommendations (standards) that can be used together with non-W3C standards (such as Unicode) to support the representation and exchange of information on the Web. All these recommendations depend upon unique identifiers using standardized character sets to identify resources on the Web. Initial efforts to support the sharing of information on the Web through the creation of Extensible Markup Language (XML)[14] focused on the representation of individual data objects (*i.e.*, instance data) together with metadata about them. Subsequent recommendations (RDF, RDFS, OWL, and SKOS) defined new representation languages that are used to formalize the semantics of data and its real-world domains in a machine-processable form. RDF, RDFS, OWL, and rule languages enable the creation of formal logical theories that support automated logical reasoning about data (*e.g.*, inferencing to conclude additional facts from known data) as well as querying distributed data resources across the Web.

SKOS is a W3C standard that defines a common data model for describing and sharing knowledge organization systems (including terminologies, taxonomies, thesauri, and categorization schemes). While SKOS is one of the newer W3C standards, it builds on earlier work in thesaurus and terminology management. SKOS provides the representation language for expressing NSG vocabularies and the concepts they represent in a format sharable on the Web.

5.4.2 Formal Constructs for NSG Vocabulary Representation

The W3C Recommendation *SKOS Simple Knowledge Organization System* (18 August 2009) defines the formal representation language which is the basis for representing NSG vocabularies (including the NCV content). SKOS elements are used together with SKOS- and OWL-based extensions to represent the concepts and properties of the NSG vocabulary information model (*e.g.*, vocabulary term, broader/narrower term relationships, and term status information). The extensions are published in two specialized ontology namespaces, whose contents are described in Annex D:

1) 'ncvx' – specialized concepts for NSG vocabulary, including VocabularyTerm, BasicVocabularyTerm, ComplexVocabularyTerm, and TermCategoryType;

[13] This diagram adds SKOS to the stack depicted in *Semantic Web and Other W3C Technologies to Watch*, by Steve Bratt, CEO, W3C (October 2006); retrieved online at: http://www.w3.org/2006/Talks/1023-sb-W3CTechSemWeb/. There is some variation in depictions of the stack, which has changed over the years with the addition of new recommendations such as the Rules Interchange Format (RIF) and the adoption of IRIs to provide a broader method than URIs for constructing unique identifiers.
[14] XML was developed in the late 1990s to provide a syntax for creating markup languages to capture metadata.

2) 'regx' – concepts representing the registry status of a term, and its relationship(s) to predecessor or successor terms, based on ISO 19135-1:2015.

Annotation properties from SKOS, OWL, RDFS, and other standards are used to document human-readable semantics (such as definitions) within the vocabulary components.

The NSG vocabulary specification uses SKOS and SKOS-based components, together with SKOS-based extensions defined in NCVX (see Annex D.2) in the following ways:

a) NSG basic vocabulary terms are represented as instances of the class `ncvx:BasicVocabularyTerm` (a subclass of `skos:Concept`).

b) NSG complex vocabulary terms are represented as instances of the class `ncvx:ComplexVocabularyTerm` (a subclass of `skos:ConceptScheme`).

c) NSG *VocabularyTerm* is a disjoint union of the classes `ncvx:BasicVocabularyTerm` and `ncvx:ComplexVocabularyTerm`.

d) Basic vocabulary terms are related to complex vocabulary terms using the relations `skos:inScheme` and `skos:topConceptOf`. The latter has the inverse `skos:hasTopConcept`.

e) Broader and narrower relationships may be declared between two basic vocabulary terms using the SKOS properties `skos:broader` and `skos:narrower`, if and only if both terms have the same termCategory.

f) Broader (`skos:broader`) and narrower (`skos:narrower`) relationships may be declared between ListedValueTerms only if they belong to the same value domain, represented by an EnumeratedTypeTerm.

g) Broader and narrower relationships may be declared between two complex vocabulary terms using the properties `ncvx:broaderComplexTerm` and `ncvx:narrowerComplexTerm`, defined in the NCVX ontology, if and only if both terms have the same termCategory.

h) `skos:Collection` is not used.

i) Several SKOS annotation properties are used for documenting an NSG vocabulary (*e.g.*, `skos:prefLabel`, `skos:definition`), along with additional properties from other W3C and non-W3C standards (*e.g.*, `rdfs:label`, `rdfs:isDefinedBy`).

5.4.3 Unique Identifiers in SKOS: IRIs

The SKOS vocabulary elements are identified using Internationalized Resource Identifiers (IRIs). An IRI is a finite-length sequence of zero or more characters used for identifying an abstract or physical resource. A resource can be anything that has identity. IRIs may be used solely for identification of resources, or they may also be used to locate and access resources.

> **NOTE** An Internationalized Resource Identifier is a sequence of characters from the Universal Character Set (Unicode/ISO 10646) that forms an identifier for a resource. IRIs complement an older format, Uniform Resource Identifiers (URIs), which allows the use of only a subset of the ASCII character set to construct identifiers. A standardized mapping from IRIs to URIs is defined in the IRI specification. When a resource identifier is used for resource retrieval, it may be necessary to determine the associated URI, because retrieval mechanisms may be defined only for URIs. Every URI is by definition an IRI.[15]

The NCV content is a Web resource identified by an IRI that is a URI. In addition, each component in an NSG vocabulary – including its terms, properties, and enumerated types – is a resource and, as such, is identified by an IRI that is a URI.

The use of URIs for the NCV content and its components is consistent with requirements for the identification of resources on the internet. The intent of the World Wide Web is to enable sharing of locatable resources across a global community with both known and unanticipated users. Information-sharing is supported by use of a single global identification system that provides a common basis for unique identification of resources across the Web. Identification of Web resources by IRIs and URIs is a recommended practice of the World Wide Web Consortium

[15] See: http://tools.ietf.org/html/rfc3987#section-3.1.

(W3C). Benefits of using URIs to locate resources include linking, caching, bookmarking, and indexing by search engines. Key to the use of URIs is that each URI should identify a single distinct resource.[16]

5.4.4 Resource Documentation for an NSG Vocabulary

An NSG vocabulary is a Semantic Web resource that is a collection of vocabulary terms which shall be documented with the following information in all NSG vocabulary resources. Both registered technical artifacts and vocabulary resources retrieved through the REST API component of the NSG Standards Registry shall be documented with the appropriate information in a comment header and encoded in the resource. Examples are presented in Section 5.5.3.

a) Namespace – The common URI base plus separator ("/") that is used to identify the vocabulary as a collection of related resources (vocabulary terms). The namespace string is used as the initial part of every unique identifier for a vocabulary term in the vocabulary namespace.

b) Resource – The name and URL for the NCV Standard document with the NSG vocabulary specification (Section 5 of this standard document).

c) Definition – The summary of essential information about the NSG vocabulary that should be used when cataloguing the NSG vocabulary resource in a register or repository.

d) Description – Additional information about the NSG vocabulary.

e) Version Number – (Registered technical-artifact encodings only) A structured character sequence including numbers, which uniquely specifies an NSG vocabulary content baseline designated as an official version.

f) Date of Last Change – (REST API encodings only) A structured character sequence indicating the most recent date on which the NSG vocabulary content included in the vocabulary encoding was changed (added, updated, or deleted).

5.5 NSG Vocabulary Encodings

5.5.1 Introduction

The NCV Standard specifies two technology-specific encodings for an NSG vocabulary. Each accurately represents the NSG vocabulary information model:

1) RDF/XML encoding – RDF/XML is an XML-based format for encoding an RDF graph.

2) N-Triples – N-Triples is a line-based, plain-text format for encoding an RDF graph that may be used in information exchange without necessitating the complicated parsing required for RDF/XML. In N-Triples, each line consists of a sequence of three RDF terms representing, respectively, the Subject, Predicate, and Object of an RDF triple.[17]

Both technologies use IRIs as described in Section 5.5.2 to uniquely identify the vocabulary resource and vocabulary components. That section also describes the method of vocabulary versioning. Section 5.5.3 describes the approach to documenting the vocabulary resource. Section 5.5.4 presents the general approach for encoding the information modeling concepts of the NSG vocabulary information model in SKOS. Section 5.5.5 presents the encoding for datatypes. Section 5.5.6 provides technology-specific guidelines for the RDF/XML and N-Triples encodings of NSG vocabularies. Section 6.2 specifies the ways in which encodings are published.

5.5.2 Namespace and Identifiers

An NSG vocabulary is a resource that comprises a set of vocabulary terms which are also resources. In the World Wide Web, resources must be uniquely identified by IRIs. Related resources may be grouped into a namespace using a specified IRI structure.

5.5.2.1 Namespace

A namespace represents a collection of resources which are referenced using identifiers (IRIs) that share a common initial prefix or "stem" (also referred to as a URI base). An RDF namespace is represented by the URI base concatenated with a separator ("/" or "#"). The namespace string is used in all identifiers for a set of related

[16] Resources are broadly inclusive of Web pages, images, concepts, and even real-world objects. *Architecture of the World Wide Web, Volume One*. W3C Recommendation 15 December 2004. Ian Jacobs and Norman Walsh, Eds. Available online at: http://www.w3.org/TR/webarch/#identification.

[17] RDF 1.1. N-Triples. W3C Recommendation. 25 February 2014. David Beckett. Published online at: http://www.w3.org/TR/n-triples/.

resources. The namespace string is followed by a locally unique name to create the complete IRI identifier for an individual RDF resource.[18]

Each IRI belongs to a single namespace. Resources from different namespaces may be combined in the construction of a new resource. NSG vocabulary encodings re-use elements from the Simple Knowledge Organization System (SKOS), Web Ontology Language (OWL), Resource Description Framework (RDF), RDF Schema (RDFS), and other standards used with Web resources. Every modeling element used by an NSG vocabulary has a unique IRI that identifies that element in relation to its original namespace. For example, the SKOS class ConceptScheme (IRI: http://www.w3.org/2004/02/skos/core#ConceptScheme) is in the SKOS namespace (IRI: http://www.w3.org/2004/02/skos/core#). Namespaces may be abbreviated using prefixes handled by XML parsers. NSG vocabulary RDF/XML encodings use prefix names for common namespaces as declared in the OWL Structural Specification (Section 2.4).

Vocabulary terms that are components of the NCV content all have a URI base that identifies them as belonging to the namespace specified for the NCV (abbreviation “ncv”), as described in the next section.

5.5.2.2 NSG Vocabulary Identifiers (IRIs)

Identifiers for the content of an NSG vocabulary (as a complete set) are constructed in accordance with the following pattern:

protocol "://" *domain* "/" *resource-type* "/" *resource*

In this pattern, each segment is case-sensitive and determined as follows:

- *protocol* – always 'http'
- *domain* –'api.nsgreg.nga.mil' for NSG vocabularies
- *resource-type* – always 'vocabulary'
- *resource* – abbreviation for a specific resource (*e.g.*, 'ncv' for the NCV content)

NSG vocabulary identifiers (IRIs) do not include a segment for indicating the version. The process of publication and versioning for NCV content baselines is addressed in Section 6.2.3.

A non-versioned identifier (IRI) is specified for the complete NCV content, as a single resource. The REST API component of the NSG Standards Registry supports the retrieval of the current NCV content using this non-versioned IRI:

- http://api.nsgreg.nga.mil/vocabulary/ncv

NSG vocabulary identifiers are IRIs in the form of a Uniform Resource Location (URL). A URL specifies the location of, and access to, a resource on the Internet. A URL specifies the protocol of the resource (*e.g.*, 'http' or 'ftp'), the domain name for the resource (*e.g.*, 'nsgreg.nga.mil'), and the relative location of the resource within that domain. If the site host is active, then accessing the specified resource results in retrieval of a representation (*i.e.*, the content) of the resource; however, site persistence is not guaranteed.

5.5.2.3 NSG Vocabulary Term Identifiers (IRIs)

A vocabulary term belonging to an NSG vocabulary has its own unique identifier, which includes the NSG vocabulary identifier (Section 5.5.2.2) as its URI base, followed by the appropriate separator and the specific term label.

In the NCV, every vocabulary term in the NCV content has its own unique identifier, which includes the NCV identifier ('http://api.nsgreg.nga.mil/vocabulary/ncv') as its URI base. An NCV vocabulary-term identifier is the combination of the URI base and (following the appropriate separator) a terminal label for the concept (*e.g.*, ‘Building’, ‘MountainPass’) that is unique within the namespace. Individual vocabulary terms do not have versioned IRIs; instead, their status and currency are indicated by properties on the vocabulary terms as defined in the information model (Table 4).

IRI component-designations in the NCV are constructed in accordance with the following pattern:

protocol "://" *domain* "/" *resource-type* "/" *resource* "/" [context “/”] *concept*

In this pattern, each segment is case-sensitive and determined as follows:

[18] In the concatenation of a URI base with a local name, a separator (which may be either the hash (“#”) or the forward slash (“/”)) character is required between the two parts. The type of separator used depends upon the supported retrieval mechanism.

- *protocol* – always 'http'
- *domain* –'api.nsgreg.nga.mil' for NSG vocabulary terms
- *resource-type* – always 'vocabulary'
- *resource* – abbreviation for a specific resource (*e.g.*, 'ncv' for NCV content)
- *context* – designates an EnumeratedTypeTerm (*e.g.*, 'AccessibilityStatusTermSet') to which a ListedValueTerm (*e.g.*, 'restricted') belongs, and which is the context for understanding the *concept*.
- *concept* – designates an individual vocabulary term (*e.g.*, 'Aerial', 'Building', 'MountainPass', 'restricted')

The individual segments are concatenated into a single string as specified by the pattern (above), to form the IRI that designates the vocabulary term. For example:

http://api.nsgreg.nga.mil/vocabulary/ncv/Building	(IRI for the NCV EntityTerm 'Building')
http://api.nsgreg.nga.mil/vocabulary/ncv/accessibilityStatus	(IRI for the NCV AttributeTerm 'accessibilityStatus')
http://api.nsgreg.nga.mil/vocabulary/quality-measure/BasicQualityMeasureTerms	(IRI for the Quality Measures Vocabulary CollectorTerm 'BasicQualityMeasureTerms')
http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet	(IRI for the NCV EnumeratedTypeTerm 'AccessibilityStatusTermSet')
http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/restricted	(IRI for the NCV ListedValueTerm 'restricted')

The IRI for a specific vocabulary term in the NCV may be used to access an individual resource (in RDF/XML or N-Triples encoding) for that vocabulary term from the REpresentational State Transfer (REST) API component of the NSG Standards Registry.

5.5.3 Resource Documentation

Each encoding of NSG vocabulary content shall be described by the information specified in Section 5.4.4. This information appears in the header of the encoding and should also be used when cataloguing an NSG vocabulary in a registry or repository. Figure 4 illustrates the inclusion of this metadata in the header of an NCV content encoding file that is a registered technical artifact. Each registered technical artifact has a version number, which is included in the documentation.

```
<!--++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+
+   NSG Core Vocabulary (NCV)
+
+   Namespace: http://api.nsgreg.nga.mil/vocabulary/ncv
+   Resource:  http://nsgreg.nga.mil/doc/view?i=4510
+              NSG Core Vocabulary (NCV) Standard, Edition 2.0 (2018-mm-dd)
+              NGA.STND.0066_2.0_NCV
+              Resource page for NCV encodings:  http://nsgreg.nga.mil/ncv
+   Definition:  The NSG Core Vocabulary (NCV) Standard defines the specification for a controlled
+                vocabulary of terms intended for use in the National System for Geospatial Intelligence
+                (NSG) community to consistently and unambiguously refer to elements of shared Geospatial
+                Intelligence (GEOINT).
+   Description: A controlled vocabulary is a set of terms consisting of defined lexical items
+                (i.e., words, phrases, or abbreviations from a natural language) that are collected
+                and managed by an authority following identified criteria for inclusion. The NSG Core Vocabulary
+                contains computer-interpretable terms represented using the W3C Simple Knowledge Organization
+                System (SKOS) and encoded in RDF/XML and N-Triples. The authority for management of the
+                NCV is established by NGA as a Standards Development Organization (SDO) and executed by
+                the GEOINT Content Standards Board (GCSB), and the criteria for term inclusion
+                are determined by NSG requirements.
+
+   Version Number:  2-1
+
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++-->
```

Figure 4 – Documentation for NCV Vocabulary as a Registered Technical Artifact

Figure 5 illustrates the inclusion of that metadata in the header of an NCV content encoding resource that is retrieved through the REST API component of the NSG Standards Registry. Each REST API resource that collects the content of the NCV has a date of last change included in the documentation, rather than a version number.

```
<!--++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+
+   NSG Core Vocabulary (NCV)
+
+   Namespace: http://api.nsgreg.nga.mil/vocabulary/ncv
+   Resource:  http://nsgreg.nga.mil/doc/view?i=4510
+              NSG Core Vocabulary (NCV) Standard, Edition 2.0 (2018-mm-dd)
+              NGA.STND.0066_2.0_NCV
+              Resource page for NCV encodings:  http://nsgreg.nga.mil/ncv
+   Definition:  The NSG Core Vocabulary (NCV) Standard defines the specification for a controlled
+                vocabulary of terms intended for use in the National System for Geospatial Intelligence
+                (NSG) community to consistently and unambiguously refer to elements of shared Geospatial
+                Intelligence (GEOINT).
+   Description: A controlled vocabulary is a set of terms consisting of defined lexical items
+                (i.e., words, phrases, or abbreviations from a natural language) that are collected
+                and managed by an authority following identified criteria for inclusion. The NSG Core Vocabulary
+                contains computer-interpretable terms represented using the W3C Simple Knowledge Organization
+                System (SKOS) and encoded in RDF/XML and N-Triples. The authority for management of the
+                NCV is the GEOINT Content Standards Board (GCSB), and the criteria for term inclusion
+                are determined by NSG requirements.
+
+   Date of Last Change:  2018-mm-ddT12:06:17Z
+
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++-->
```

Figure 5 – Documentation for NCV Vocabulary as a REST API Resource

The encoding instructions for documenting a vocabulary resource are presented in Table 16 below. Differences in encoding for documenting resources that are registered technical artifacts versus REST API resources are addressed in the Notes column.

Table 16 – Encodings for NCV Vocabulary Resource Documentation

Ref #	Vocabulary Documentation	Encoding Element	Cardinality of Element	Value Type	Notes / Examples
1	Ontology	`owl:Ontology`			Used to declare an element representing the complete resource. - Declared in RDF/XML using rdf:about. - Declared in N-Triples by declaring the subject (the ontology IRI) to be of the rdf:type owl:Ontology.
2	Name (IRI)	`owl:ontologyIRI`	Exactly one	IRI	For example (NCV): http://api.nsgreg.nga.mil/vocabulary/ncv Note: The ontology namespace is the ontologyIRI with the appropriate separator appended (for NCV: "/").
3	Version Number	`owl:versionInfo`	If applicable, then exactly one (**Mandatory** for content baselines)	CharacterString	*Applies to content baselines only.* For example: (NCV content baseline): "2-1"
4	Label	`rdfs:label`	Exactly one	LocalizedContinuousString	For example (NCV): "NsgCoreVocabulary"
5	Resource (Name)	`skos:prefLabel`	Exactly one	LocalizedCharacterString	For example (NCV): "NSG Core Vocabulary"
6	Resource (Abbreviation)	`skos:altLabel`	Zero or more	LocalizedCharacterString	For example (NCV): "NCV"
7	Resource (URL)	`rdfs:isDefinedBy`	Exactly one	IRI	For the NCV Standard, Edition 2.0, the URL is: http://nsgreg.nga.mil/doc/view?i=4510 *Applies to all NEV components based on NCV Ed. 2.0.*
8	Resource (Full Title)	`dct:source`	Exactly one	LocalizedCharacterString	For example (NCV Ed2.0): "NSG Core Vocabulary (NCV) Standard, Edition 2.0, NGA.STND.0066_2.0_NCV" *Applies to all NEV components based on NCV Ed. 2.0.*
9	Date of Last Change	`regx:dateOfLastChange`	If applicable, then exactly one (**Mandatory** for REST API resources)	DateTime	*Applies to REST API resources only.* For example (NCV REST API resource): "2018-08-01T12:06:17Z"

Ref #	Vocabulary Documentation	Encoding Element	Cardinality of Element	Value Type	Notes / Examples
10	Definition and Description	`skos:definition`	Exactly one	LocalizedCharacterString	For example (NCV): "Definition: The NSG Core Vocabulary (NCV) Standard defines the specification for a controlled vocabulary of terms intended for use in the National System for Geospatial Intelligence (NSG) community to consistently and unambiguously refer to elements of shared Geospatial Intelligence (GEOINT). Description: A controlled vocabulary is a set of terms consisting of defined lexical items (i.e., words, phrases, or abbreviations from a natural language) that are collected and managed by an authority following identified criteria for inclusion. The NSG Core Vocabulary contains computer-interpretable terms represented in the W3C Simple Knowledge Organization System (SKOS) and encoded in RDF/XML and N-Triples. The authority for management of the NSG controlled vocabularies is established by NGA as a Standards Development Organization (SDO) and executed by the Geospatial Intelligence (GEOINT) Content Standards Board (GCSB), and the criteria for term inclusion are determined by NSG requirements. Resource page for NCV encodings: http://nsgreg.nga.mil/ncv."
11	Dependencies	`owl:imports`	Zero or more	Ontology	(Encodings) The imported ontology is represented by its IRI. For example: http://api.nsgreg.nga.mil/ontology/ncvx/2.0

5.5.4 General Encoding for Contents of an NSG Vocabulary

5.5.4.1 Introduction

The NSG vocabulary information model was specified in Section 5.3. This section defines the general approach for encoding elements of the information model that are applicable to both the RDF/XML and N-Triples encodings.

Encoding elements for the conceptual components of the NSG vocabulary information model are defined in the set of tables in this section. The table format used to document these encoding elements is as follows:

- The **NSG Vocabulary Modeling Concept** column specifies the class name, class attribute name, or class role name of the information modeling concept.
- The **NSG Vocabulary Encoding Element** column specifies the SKOS (or other standard) construct that shall be used to represent the corresponding NSG Vocabulary Modeling Concept.
- The **Cardinality of Element** column indicates the number of occurrences of the element that are permitted by the information model.
- The **Value Type** column indicates the modeling concept that is used to define the value(s) of the element. Encodings for datatypes are specified in Section 5.5.5.
- The **Notes** column contains comments, specification of the actual value, or examples of values for the element.

The modeling concept *VocabularyTerm* was presented in Section 5.3.3 to explain the general concept of a vocabulary term as a defined lexical item that can be described by metadata about its status in a controlled vocabulary. The class *VocabularyTerm* is abstract and therefore not directly encoded; its subclasses *BasicVocabularyTerm* and *ComplexVocabularyTerm* are also abstract. Individual vocabulary terms are specified as instances of the concrete subclasses EntityTerm, AttributeTerm, ListedValueTerm, CollectorTerm, and EnumeratedTypeTerm, which are encoded as specified in the following sections.

5.5.4.2 Encoding for EntityTerm, AttributeTerm, and ListedValueTerm

The specific concrete subclasses of *BasicVocabularyTerm* are encoded using `ncvx:BasicVocabularyTerm` and the required property termCategory with the appropriate value specifying the subclass.

Table 17 – Encoding Elements for EntityTerm, AttributeTerm, and ListedValueTerm

Ref #	NSG Vocabulary Modeling Concept	NSG Vocabulary Encoding Element	Cardinality of Element	Value Type	Notes
1	*BasicVocabularyTerm {Abstract}*	`ncvx:BasicVocabularyTerm`			Instances of specific concrete subclasses of *BasicVocabularyTerm* shall be encoded using the required property termCategory (encoded using `ncvx:termCategory`).
2	termIRI	`rdf:about`	Exactly one	IRI	Used in declaring the vocabulary term identifier (IRI) in RDF/XML.
3	label	`rdfs:label`	Exactly one	LocalizedContinuousString	For example: 'LandAerodrome' (no white spaces)
4	name	`skos:prefLabel`	Exactly one	LocalizedCharacterString	For example: "Land Aerodrome"
5	alias	`skos:altLabel`	Zero or more	LocalizedCharacterString	For example: "Airport"
6	definitionNote	`skos:definition`	Exactly one	LocalizedCharacterString	For example: (Land Aerodrome) "Definition: An aerodrome on land intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft."
7	sourceIRI	`rdfs:isDefinedBy`	Exactly one	IRI	For example: (Land Aerodrome) "http://nsgreg.nga.mil/voc/view?i=800610"
8	termCategory	`ncvx:termCategory`	Exactly one	TermCategoryType	(a) If encoding an EntityTerm, then `ncvx:termCategory = http://api.nsgreg.nga.mil/ontology/ncvx/2.0/TermCategoryType/entity`
					(b) If encoding an AttributeTerm, then `ncvx:termCategory = http://api.nsgreg.nga.mil/ontology/ncvx/2.0/TermCategoryType/attribute`
					(c) If encoding a ListedValueTerm, then `ncvx:termCategory = http://api.nsgreg.nga.mil/ontology/ncvx/2.0/TermCategoryType/listedValue`
9	termStatus	`regx:itemStatus`	Exactly one	TermStatusType	
10	dateAccepted	`regx:dateAccepted`	Exactly one	DateTime	

Ref #	NSG Vocabulary Modeling Concept	NSG Vocabulary Encoding Element	Cardinality of Element	Value Type	Notes
11	dateAmended	`regx:dateAmended`	If applicable, then exactly one.	DateTime	
12	*Role name:* predecessorTerm	`regx:predecessor`	If applicable, then exactly one.	*VocabularyTerm*	The vocabulary terms in this relationship are identified by their IRIs.
13	*Role name:* successorTerm	`regx:successor`	If applicable, then one or more.	*VocabularyTerm*	The vocabulary terms in this relationship are identified by their IRIs.
14	*Role name:* broaderBasicTerm	`skos:broader`	If applicable, then one or more.	*BasicVocabularyTerm*	The basic vocabulary terms in this relationship are identified by their IRIs. Terms related by broaderBasicTerm shall have the same value for termCategory.
15	*Role name:* narrowerBasicTerm	`skos:narrower`	If applicable, then one or more.	*BasicVocabularyTerm*	The basic vocabulary terms in this relationship are identified by their IRIs. Terms related by narrowerBasicTerm shall have the same value for termCategory.
16	*Role name:* memberTermOf	`skos:inScheme`	If applicable, then exactly one.	*ComplexVocabularyTerm*	The complex vocabulary terms in this relationship are identified by their IRIs. Each ListedValueTerm shall be a member of exactly one EnumeratedTypeTerm. A ListedValueTerm shall be a member of only an EnumeratedTypeTerm. An EntityTerm shall be a member of only a CollectorTerm(s). An AttributeTerm shall be a member of only a CollectorTerm(s).
17	*Role name:* topTermOf	`skos:topConceptOf`	If applicable, then exactly one.	*ComplexVocabularyTerm*	The complex vocabulary terms in this relationship are identified by their IRIs.

5.5.4.3 Encoding for ComplexVocabularyTerm

The specific concrete subclasses of *ComplexVocabularyTerm* are encoded using `ncvx:ComplexVocabularyTerm` and the required property termCategory with the appropriate value specifying the subclass. The encoding for the different-terms axioms that accompany the declaration of complex vocabulary terms is specified in Section 5.5.4.4.

Table 18 – Encoding Elements for ComplexVocabularyTerm

Ref #	NSG Vocabulary Modeling Concept	NSG Vocabulary Encoding Element	Cardinality of Element	Value Type	Notes
1	*ComplexVocabularyTerm {Abstract}*	`ncvx:ComplexVocabularyTerm`			Instances of specific concrete subclasses of *ComplexVocabularyTerm* are encoded using the required property termCategory (encoded using `ncvx:termCategory`).
2	termIRI	`rdf:about`	Exactly one	IRI	Used in declaring the vocabulary term identifier (IRI) in RDF/XML.
3	label	`rdfs:label`	Exactly one	LocalizedContinuousString	For example: 'AccessibilityStatusTermSet' (no white spaces)
4	name	`skos:prefLabel`	Exactly one	LocalizedCharacterString	For example: 'Accessibility Status Term Set'
5	alias	`skos:altLabel`	Zero or more	LocalizedCharacterString	For example: 'Accessibility Information'
6	definitionNote	`skos:definition`	Exactly one	LocalizedCharacterString	For example: (Accessibility Status Term Set) "Definition: A type of control exerted over the ability to enter or exit a feature, as a specified set of terms."
7	sourceIRI	`rdfs:isDefinedBy`	Exactly one	IRI	For example: (AccessibilityStatusTermSet) "http://nsgreg.nga.mil/voc/view?i=803307"

Ref #	NSG Vocabulary Modeling Concept	NSG Vocabulary Encoding Element	Cardinality of Element	Value Type	Notes
8	termCategory	`ncvx:termCategory`	Exactly one	TermCategoryType	(a) If encoding CollectorTerm, then `ncvx:termCategory =` `http://api.nsgreg.nga.mil/ontology/ncvx/2.0/TermCategoryType/collector` (b) If encoding EnumeratedTypeTerm, then `ncvx:termCategory =` `http://api.nsgreg.nga.mil/ontology/ncvx/2.0/TermCategoryType/enumeratedType`
9	termStatus	`regx:itemStatus`	Exactly one	TermStatusType	One of: 'valid', 'superseded', 'retired'
10	dateAccepted	`regx:dateAccepted`	Exactly one	DateTime	
11	dateAmended	`regx:dateAmended`	If applicable, then exactly one.	DateTime	
12	*Role name:* predecessorTerm	`regx:predecessor`	If applicable, then exactly one.	*VocabularyTerm*	The vocabulary terms in this relationship are identified by their IRIs. The termCategory value of the predecessor term shall be the same as the termCategory value of the successor term.
13	*Role name:* successorTerm	`regx:successor`	If applicable, then one or more.	*VocabularyTerm*	Vocabulary terms in this relationship are identified by their IRIs. The termCategory value of the predecessor term shall be the same as the termCategory value of the successor term.
14	domainComplete	`ncvx:domainComplete`	If applicable, then exactly one.	Boolean	Mandatory for EnumeratedTypeTerms; otherwise, optional. The default assumption is FALSE.

Ref #	NSG Vocabulary Modeling Concept	NSG Vocabulary Encoding Element	Cardinality of Element	Value Type	Notes
15	*Role name:* hasTopTerm	`skos:hasTopConcept`	If applicable, then one or more.	*BasicVocabularyTerm*	The vocabulary terms in this relationship are identified by their IRIs. CollectorTerms shall have only EntityTerms and/or AttributeTerms as members. EnumeratedTypeTerms shall have only ListedValueTerms as members.
16	*Role name:* broaderComplexTerm	`ncvx:broaderComplexTerm`	If applicable, then one or more.	*ComplexVocabularyTerm*	The complex vocabulary terms in this relationship are identified by their IRIs.
17	*Role name:* narrowerComplexTerm	`ncvx:narrowerComplexTerm`	If applicable, then one or more.	*ComplexVocabularyTerm*	The complex vocabulary terms in this relationship are identified by their IRIs.

The membership association between a basic vocabulary term and a complex vocabulary term is represented by the unidirectional association role memberTermOf, only in the direction from the basic vocabulary term to the complex vocabulary term (see Table 17 (row 16)), and encoded using `skos:inScheme`. The SKOS representation language does not define an inverse for `skos:inScheme`.

The association role hasTopTerm (row 15, above) relates a complex vocabulary term to any of its member terms that has no broader term. In the case of a complex vocabulary term whose basic vocabulary terms do not form a hierarchy, all its member terms are also top terms. In the case of a complex vocabulary term whose basic vocabulary terms form a hierarchy with broader and narrower term relations, only the terms with no broader term are top terms (encoded using `skos:hasTopConcept`). The examples in Figure 6 and Figure 7 illustrate the encoding of an EnumeratedTypeTerm whose ListedValueTerms have hierarchical (*i.e.*, broader and narrower) relationships. The specification of the EnumeratedTypeTerm lists only the members that are top concepts. By contrast, all the members are included in the DifferentTerms class axiom that declares all the member terms to be distinct.

5.5.4.4 Encoding of the DifferentTerms Class Axiom

In the NSG vocabulary information model, the class DifferentTerms represents a collection of individual vocabulary terms that are pairwise distinct.[19] NSG vocabulary encodings use the OWL Class `owl:AllDifferent` to encode axioms declaring the distinctness of a list of specified vocabulary terms.[20] The property distinctMemberTerm (encoded by `owl:distinctMembers`) is used to identify each vocabulary term. In the NCV content, DifferentTerms is used to declare the pairwise distinctness of vocabulary terms that are members of a CollectorTerm or an EnumeratedTypeTerm.

[19] Individual vocabulary terms may overlap in meaning (*e.g.*, ListedValueTerms in hierarchical (broader-than) relationships), but they are not identical, and their meanings are distinct.
[20] The NSG vocabulary encoding uses `owl:AllDifferent` to represent all class axioms that declare the distinctness of two or more vocabulary terms. The OWL 2 Functional Syntax maps the OWL concept DifferentIndividuals to RDF graphs using `owl:differentFrom` for two individuals, and `owl:AllDifferent` for three or more individuals. However, RDF graphs containing `owl:AllDifferent` (with two or more individuals) are mapped to DifferentIndividuals in the OWL 2 Functional syntax; therefore, there is no difference in meaning between the two RDF syntactic structures. See *OWL 2 Mapping to RDF, Section 3.2.5 Parsing of Axioms*.

Table 19 – Encoding Elements for DifferentTerms

Ref #	NCV Modeling Concept	NCV Encoding Element	Cardinality of Element	Value Type	Notes
1	DifferentTerms	`owl:AllDifferent`			
2	distinctMemberTerm	`owl:distinctMembers`	If applicable, then two or more.	*VocabularyTerm*	Each vocabulary term is identified by its IRI

Both the RDF/XML and N-Triples encodings of an NSG vocabulary represent DifferentTerms using the encoding elements above. There are some differences in the implementation-specific encodings, which are discussed in Section 5.5.6.

5.5.5 General Encoding of Datatypes

The basic datatypes included in the NSG vocabulary information model are represented as follows:

a) The datatype IRI is represented using the XML datatype `xsd:anyURI`, as specified in the OWL 2 Structural Specification and Functional-Style Syntax.

b) The datatype DateTime is represented using the XML datatype `xsd:dateTime` as specified in the OWL 2 Structural Specification and Functional-Style Syntax.

c) The datatype IANALanguageSubtag is represented using a codelist of values consisting of the lowercase two-character codes contained in the Language Subtag registry administered by the Internet Assigned Numbers Authority (IANA) in accordance with the Internet Engineering Task Force (IETF) Recommendation for Comment (RFC) 5646.[21]

d) The datatype Boolean is represented using the XML datatype for OWL 2, `xsd:boolean`, as specified in the OWL 2 Structural Specification and Functional-Style Syntax.

e) The datatype CharacterString is represented using the `rdf:PlainLiteral` datatype provided in OWL 2 to support the representation of strings in a particular language, as specified in the OWL 2 Structural Specification and Functional-Style Syntax: Section 4.3. The `rdf:PlainLiteral` value may be either a character string (`xsd:string`), or an ordered pair consisting of a character string (`xsd:string`) and a lower-case language code (*e.g.*, "en" for English).[22]

f) The datatype LocalizedCharacterString is represented using the `rdf:PlainLiteral` datatype with the requirement that the language of the character string (`xsd:string`) shall be identified by a lower-case language code (*e.g.*, "en" for English).

g) The datatype LocalizedContinuousString is represented using the `rdf:PlainLiteral` datatype with the requirements that (1) the language of the character string (`xsd:string`) shall be identified by a lower-case language code (*e.g.*, "en" for English), and (2) the character string shall contain no white spaces.

h) The enumerated datatype TermCategoryType is represented using the enumeration `ncvx:TermCategoryType`, as defined in the 'ncvx' namespace.

i) The enumerated datatype TermStatusType is represented using the enumeration `regx:ItemStatusType`, as defined in the 'regx' namespace.

5.5.6 Technology-specific NSG Vocabulary Encodings

5.5.6.1 Introduction

The NCV Standard defines two technology-specific encodings for NSG vocabularies conformant with the information model specified in the NCV Standard:

a) RDF/XML encoding – RDF/XML is an XML-based syntax for encoding an RDF graph as an XML document.

b) N-Triples – A line-based, plain-text format for encoding an RDF graph.[23]

Encodings provide machine-processable representations of NSG vocabulary terms that can be used in the storage or exchange of information by automated information systems that support Semantic Web applications. For example, NCV content encoded in RDF/XML may be used by Semantic Web tools that index or tag instance documents, while NCV content encoded in N-Triples may be used to apply the vocabulary terms to data items in Linked Data stores.

The publication of the NCV encodings and how to obtain them is described in Section 6.2.

[21] The complete registry content is available at the following URL: http://www.iana.org/assignments/language-subtag-registry/language-subtag-registry.
[22] W3C. *rdf:PlainLiteral: A Datatype for RDF Plain Literals*. 11 December 2012. Available online at: http://www.w3.org/TR/2012/REC-rdf-plain-literal-20121211/#Definition_of_the_rdf:PlainLiteral_Datatype.
[23] RDF 1.1. N-Triples. W3C Recommendation. 25 February 2014. David Beckett. Published online at: http://www.w3.org/TR/n-triples/.

5.5.6.2 RDF/XML Encoding

The NCV Standard specifies a technology-specific encoding of the NSG vocabulary information model using RDF/XML. The RDF/XML encoding closely follows the general encoding for the NSG vocabulary information model, with the following technology-specific techniques applied:

a) Assertions about distinct vocabulary terms are expressed using the expression `owl:AllDifferent` with a list of the different individual terms. The encoding specified in Section 5.5.4.4 is used for all collections of distinct vocabulary terms, whether there are two or more terms.

b) Character strings in the definitionNote (`skos:definition`) may be encoded using the XML CDATA wrapper.[24]

c) The `xml:lang` attribute is used with properties having character strings as values, in order to indicate that their content is in English (language code “en”).

Figure 6 presents an example of the RDF/XML encoding for AccessibilityStatusTermSet. This EnumeratedTypeTerm has a hierarchically ordered set of ListedValueTerms as members. AccessibilityStatusTermSet is encoded with its top concepts only. All members of AccessibilityStatusTermSet are listed in the DifferentTerms axiom that declares all terms to be distinct individuals. The membership relationships of all member terms, together with their broader-term relations, are declared on the individual ListedValueTerms (not shown).

[24] In XML the CDATA wrapper is used to indicate to parsers that the enclosed content should not be further interpreted; this allows applications to use characters in data exchange that would otherwise be misinterpreted as element or entity markup.

```
    <ncvx:ComplexVocabularyTerm rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet">
        <rdfs:label xml:lang="en">AccessibilityStatusTermSet</rdfs:label>
        <skos:prefLabel xml:lang="en"><![CDATA[Accessibility Status Term Set]]></skos:prefLabel>
        <skos:definition xml:lang="en"><![CDATA[Definition: The type of control exerted over the ability to enter or exit a feature,
as a specified set of terms.  Description: [None Specified]]]></skos:definition>
        <rdfs:isDefinedBy rdf:resource="http://nsgreg.nga.mil/voc/view?i=803307"/>
        <skos:hasTopConcept rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/closed"/>
        <skos:hasTopConcept rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/limited"/>
        <skos:hasTopConcept rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/locked"/>
        <skos:hasTopConcept rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/open"/>
        <skos:hasTopConcept rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/restricted"/>
        <ncvx:termCategory>enumeratedType</ncvx:termCategory>
        <ncvx:domainComplete>true</ncvx:domainComplete>
        <dct:isPartOf rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv"/>
        <regx:itemStatus>valid</regx:itemStatus>
        <regx:dateAccepted>2016-10-25T00:00:00Z</regx:dateAccepted>
    </ncvx:ComplexVocabularyTerm>
    <owl:AllDifferent>
        <owl:distinctMembers rdf:parseType="Collection">
            <rdf:Description rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/closed"/>
            <rdf:Description rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/limited"/>
            <rdf:Description rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/locked"/>
            <rdf:Description rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/lockedClosed"/>
            <rdf:Description rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/lockedOpen"/>
            <rdf:Description rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/open"/>
            <rdf:Description rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/restricted"/>
        </owl:distinctMembers>
    </owl:AllDifferent>
```

Figure 6 – RDF/XML Encoding: EnumeratedTypeTerm `AccessibilityStatusTermSet` with DifferentTerms Axiom

5.5.6.3 N-Triples Encoding

The NCV Standard specifies a technology-specific encoding of the NSG vocabulary information model using N-Triples. The W3C Recommendation RDF 1.1 N-Triples specifies a line-based, plain text format for encoding an RDF graph with each triple presented on a separate line followed by a period. N-Triples files do not contain special parsing instructions.

The N-Triples encoding closely follows the general encoding for the NSG vocabulary information model, with the following technology-specific encodings applied:

a) The XML CDATA wrapper is not used in the N-Triples encoding of the definitionNote (`skos:definition`).

b) Language codes are attached to character strings (using '`@`') to indicate that their content is in English.

c) Namespace abbreviations are not used in the N-Triples encoding; instead, fully-specified IRIs are used. For example: http://www.w3.org/2002/07/owl#AllDifferent.

Figure 7 presents an example of the N-Triples encoding for AccessibilityStatusTermSet. This EnumeratedTypeTerm has a hierarchically ordered set of ListedValueTerms as members. AccessibilityStatusTermSet is encoded with its top concepts only. The membership relationships of all member terms, together with their broader-term relations, are declared on the individual ListedValueTerms (not shown).

```
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
<http://api.nsgreg.nga.mil/ontology/ncvx/2.0/ComplexVocabularyTerm> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://www.w3.org/2000/01/rdf-schema#label>
"AccessibilityStatusTermSet"@en .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://www.w3.org/2004/02/skos/core#prefLabel> "Accessibility
Status Term Set"@en .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://www.w3.org/2004/02/skos/core#definition> "Definition: A
type of control exerted over the ability to enter or exit a feature, as a specified set of terms.  Description: [None Specified]"@en
.
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://www.w3.org/2000/01/rdf-schema/isDefinedBy>
<http://nsgreg.nga.mil/voc/view?i=803307> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://www.w3.org/2004/02/skos/core#hasTopConcept>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/closed> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://www.w3.org/2004/02/skos/core#hasTopConcept>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/limited> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://www.w3.org/2004/02/skos/core#hasTopConcept>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/locked> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://www.w3.org/2004/02/skos/core#hasTopConcept>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/open> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://www.w3.org/2004/02/skos/core#hasTopConcept>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/restricted> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://api.nsgreg.nga.mil/ontology/ncvx/2.0/termCategory>
"enumeratedType"^^<http://www.w3.org/2001/XMLSchema#string> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://api.nsgreg.nga.mil/ontology/ncvx/2.0/domainComplete>
"true"^^<http://www.w3.org/2001/XMLSchema#boolean> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://purl.org/dc/terms/isPartOf>
<http://api.nsgreg.nga.mil/vocabulary/ncv> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://api.nsgreg.nga.mil/ontology/regx/1.0/itemStatus>
"valid"^^<http://www.w3.org/2001/XMLSchema#string> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet> <http://api.nsgreg.nga.mil/ontology/regx/1.0/dateAccepted>
"2016-10-25T00:00:00Z"^^<http://www.w3.org/2001/XMLSchema#dateTime> .
```

Figure 7 – N-Triples Encoding: EnumeratedTypeTerm `AccessibilityStatusTermSet`

The N-Triples encoding implements the following technology-specific encodings for the DifferentTerms axioms:

a) In N-Triple format, NSG vocabulary DifferentTerms axioms are expressed using the class expression `owl:AllDifferent` with a list of the distinct vocabulary terms.

b) The encoding of `owl:AllDifferent` in N-Triples results in the use of blank nodes to represent: (1) the `owl:AllDifferent` container, and (2) declarations for each vocabulary term as a member of a list of different individuals. A blank node is a node in an RDF graph that has no IRI identifier. Blank nodes have labels beginning with "_:". These are not IRIs and cannot be referenced outside of the local graph.

Figure 8 presents an example of the N-Triples encoding for the DifferentTerms axiom for AccessibilityStatusTermSet, which lists all of the member terms and declares them to be distinct from each other.

```
_:GCSR01CB24F71C37415C817E7250E7685D84 <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://www.w3.org/2002/07/owl#AllDifferent>
.
_:GCSR01CB24F71C37415C817E7250E7685D84 <http://www.w3.org/2002/07/owl#distinctMembers> _:GCSRF0C9C334D84F423FB488505AB559B566 .
_:GCSRF0C9C334D84F423FB488505AB559B566 <http://www.w3.org/1999/02/22-rdf-syntax-ns#first>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/closed> .
_:GCSRF0C9C334D84F423FB488505AB559B566 <http://www.w3.org/1999/02/22-rdf-syntax-ns#rest> _:GCSRA1007691521C4EC99C22BFDCB9B091DA .
_:GCSRA1007691521C4EC99C22BFDCB9B091DA <http://www.w3.org/1999/02/22-rdf-syntax-ns#first>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/limited> .
_:GCSRA1007691521C4EC99C22BFDCB9B091DA <http://www.w3.org/1999/02/22-rdf-syntax-ns#rest> _:GCSR638A3662B4524A9A9FE8C7901622ABE3 .
_:GCSR638A3662B4524A9A9FE8C7901622ABE3 <http://www.w3.org/1999/02/22-rdf-syntax-ns#first>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/locked> .
_:GCSR638A3662B4524A9A9FE8C7901622ABE3 <http://www.w3.org/1999/02/22-rdf-syntax-ns#rest> _:GCSR1C2D11230BD748379315FCCE5386BA0D .
_:GCSR1C2D11230BD748379315FCCE5386BA0D <http://www.w3.org/1999/02/22-rdf-syntax-ns#first>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/lockedClosed> .
_:GCSR1C2D11230BD748379315FCCE5386BA0D <http://www.w3.org/1999/02/22-rdf-syntax-ns#rest> _:GCSRA28B099185284EB99F7870EF6CCEC1F6 .
_:GCSRA28B099185284EB99F7870EF6CCEC1F6 <http://www.w3.org/1999/02/22-rdf-syntax-ns#first>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/lockedOpen> .
_:GCSRA28B099185284EB99F7870EF6CCEC1F6 <http://www.w3.org/1999/02/22-rdf-syntax-ns#rest> _:GCSR1695FF1CD2C649479D421D76BBFD0891 .
_:GCSR1695FF1CD2C649479D421D76BBFD0891 <http://www.w3.org/1999/02/22-rdf-syntax-ns#first>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/open> .
_:GCSR1695FF1CD2C649479D421D76BBFD0891 <http://www.w3.org/1999/02/22-rdf-syntax-ns#rest> _:GCSR16950383CA494DEF9DE3943E28186745 .
_:GCSR16950383CA494DEF9DE3943E28186745 <http://www.w3.org/1999/02/22-rdf-syntax-ns#first>
<http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/restricted> .
_:GCSR16950383CA494DEF9DE3943E28186745 <http://www.w3.org/1999/02/22-rdf-syntax-ns#rest> <http://www.w3.org/1999/02/22-rdf-syntax-
nil> .
```

Figure 8 – N-Triples Encoding: DifferentTerms Axiom for `AccessibilityStatusTermSet`

6 Governance

6.1 Introduction

The management of the NCV Standard conforms to the governance process established by NGA and executed by the Geospatial Intelligence (GEOINT) Content Standards Board (GCSB). The scope, roles, and governance process of the GCSB are specified in the *GEOINT Content Standards Board (GCSB) Operations Guide*. Changes to the NCV Standard and its associated NCV content shall conform to that process. The GCSB is the community forum responsible for providing governance, community coordination, prioritization of content development, and notifications for the set of NGA-developed GEOINT Data Standards that define a common method for specifying and encoding geospatial intelligence and related geospatial information in the National System for Geospatial Intelligence (NSG).

The NCV Standard and its associated NCV content evolve in response to GCSB management.[25] The GCSB is responsible for approving changes, distributing change notifications, and publishing the NCV Standard and its associated technical artifacts and other online resources containing the encodings of NCV content for use by the U.S. Department of Defense (DoD), U.S. Intelligence Community (IC), and U.S. civil federal agencies. The NCV Standard and its associated technical artifacts are published in the NSG-unique Standards Register of the NSG Standards Registry. The NCV content is presented in human-readable form in the NCV Register of the NSG Standards Registry. NCV content is also accessible through the REST API component of the NSG Standards Registry.

6.2 Official Publication of the NCV Standard and NCV Content

6.2.1 Introduction

The NCV Standard and its associated NCV content shall be published in accordance with the general process described in the GCSB Operations Guide, Section 2.3.5 (Implementation of Changes).

The specific managed content of the NCV Standard consists of:

1) vocabulary terms registered in the online NCV Register of the NSG Standards Registry;
2) technical artifacts published in the NSG-unique Standards Register of the NSG Standards Registry; and
3) online resources retrievable through the REST API component of the NSG Standards Registry.

All official publications of NCV content shall conform to the NSG vocabulary information model specified in Section 5.3 of the NCV Standard. All encodings shall conform to the SKOS representation and encoding for the NSG vocabulary information model, as specified in Section 5.4 and Section 5.5.

The NCV Standard itself is published in the NSG-unique Standards Register of the NSG Standards Registry.

6.2.2 Publication of NCV Content in the NCV Register

The evolving content of the NCV is published online in the NCV Register of the NSG Standards Registry (http://nsgreg.nga.mil/voc/registers.jsp?register=NCV).[26] Entries in the NCV Register are NSG vocabulary terms, accompanied by their status in the vocabulary (5.3.6.9). Register content is searchable and browsable. A collection of all registered vocabulary terms whose status is 'valid' may be designated as a "content baseline".

6.2.3 Publication of NCV Content as a Technical Artifact

The NCV content is established by publication of a technical artifact containing an encoding of the complete set of content at the time of publication ("content baseline"). The NCV technical artifacts are registered files containing NCV content baselines encoded as specified in Section 5.5 of this standard. A new content baseline is produced when the vocabulary content changes due to vocabulary terms being added, modified, replaced, or retired. Each content baseline is assigned a unique version designation indicating the major edition of the NCV Standard to which it conforms, followed by a hyphen ('-') and the sequential number of the baseline (*e.g.*, '1-4', '1-10', '2-1'). The version designation of an NSG vocabulary content baseline is documented in the metadata of the technical artifacts in which the encoding of that content is published (see Section 5.4.4 and Section 5.5.3). For each content baseline of the

[25] The initial NCV content was derived from a subset of the content of the NSG Feature Data Dictionary (NFDD), Base 17-April.
[26] The NCV Register conforms to the information model and management procedures established by ISO 19135, *Geographic information – Procedures for item registration*, which (1) specifies procedures to be followed in establishing, maintaining and publishing registers of unique, unambiguous, and permanent identifiers and meanings that are assigned to items of geographic information, and (2) specifies elements of information that are necessary to provide identification and meaning to the registered items and to manage the registration of those items.

NCV, two technical artifacts encoding the NCV content baseline in SKOS are published, one in RDF/XML format and one in N-Triples format. Each file contains the complete NCV content as of the official date of the baseline. The encoding files for each NCV content baseline are published in the NSG-unique Standards Register of the NSG Standards Registry; the latest versions are available at the following non-versioned URL: http://api.nsgreg.nga.mil/vocabulary/ncv.

The encoding files for content baselines are machine-processable semantic resources. Their content may be directly examined in a text editor; however, an application capable of displaying SKOS with a graphical user interface may be used to inspect NCV terms in a more human-friendly manner. A sample use of an ontology viewer to view SKOS is presented in Annex E.

NCV content baselines may be established concurrently with the publication of a new edition of this standard, or solely based on changes to the NCV content.

Versions of NCV content baselines shall be used for authoritative identification of NCV content in information exchange and data sharing and for official specification of the NCV content to be used in systems development or acquisition.

6.2.4 Publication of NCV Content as REST API-accessible Resources

The NCV content is also published as a set of online resources that may be accessed through the REST API component of the NSG Standards Registry. These Web resources represent individual vocabulary terms in the NCV. HTTP content negotiation based on the Accept request-header field may be used to specify the media type (as RDF/XML or N-Triples format) when resource retrieval is requested. Each individual resource file shall include a `dct:isPartOf` assertion that links that individual resource to the NCV namespace. Each individual resource file representing a complex vocabulary term shall contain a *DifferentTerms* assertion declaring the distinctness of all the basic vocabulary terms that are members of the domain represented by that complex vocabulary term.

A resource containing the collection of all individual resource encodings may be retrieved through the REST API as a complete resource with documentation as described in Section 5.5.3.

Sample content of individual-resource files with encodings for ‘LandAerodrome’ is presented below in Figure 9 (in RDF/XML) and Figure 10 (in N-Triples).

```
    <ncvx:BasicVocabularyTerm rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome">
        <rdfs:label xml:lang="en">LandAerodrome</rdfs:label>
        <skos:prefLabel xml:lang="en"><![CDATA[Land Aerodrome]]></skos:prefLabel>
        <skos:altLabel xml:lang="en"><![CDATA[Airport]]></skos:altLabel>
        <skos:altLabel xml:lang="en"><![CDATA[Airfield]]></skos:altLabel>
        <skos:definition xml:lang="en"><![CDATA[Definition: An aerodrome on land intended to be used either wholly or in part for the
arrival, departure and surface movement of aircraft.  Description: [None Specified]]]></skos:definition>
        <rdfs:isDefinedBy rdf:resource="http://nsgreg.nga.mil/voc/view?i=800610"/>
        <ncvx:termCategory>entity</ncvx:termCategory>
        <dct:isPartOf rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv"/>
        <regx:itemStatus>valid</regx:itemStatus>
        <regx:dateAccepted>2016-10-25T00:00:00Z</regx:dateAccepted>
    </ncvx:BasicVocabularyTerm>
```

Figure 9 – Individual Resource in RDF/XML Encoding for Basic Term `LandAerodrome`

```
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type>
<http://api.nsgreg.nga.mil/ontology/ncvx/2.0/BasicVocabularyTerm> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://www.w3.org/2000/01/rdf-schema#label> "LandAerodrome"@en .
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://www.w3.org/2004/02/skos/core#prefLabel> "Land Aerodrome"@en .
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://www.w3.org/2004/02/skos/core#altLabel> "Airport"@en .
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://www.w3.org/2004/02/skos/core#altLabel> "Airfield"@en .
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://www.w3.org/2004/02/skos/core#definition> "Definition: An aerodrome on
land intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft.  Description: [None
Specified]"@en .
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://www.w3.org/2000/01/rdf-schema/isDefinedBy>
<http://nsgreg.nga.mil/voc/view?i=800610> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://api.nsgreg.nga.mil/ontology/ncvx/2.0/termCategory>
"entity"^^<http://www.w3.org/2001/XMLSchema#string> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://purl.org/dc/terms/isPartOf> <http://api.nsgreg.nga.mil/vocabulary/ncv>
.
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://api.nsgreg.nga.mil/ontology/regx/1.0/itemStatus>
"valid"^^<http://www.w3.org/2001/XMLSchema#string> .
<http://api.nsgreg.nga.mil/vocabulary/ncv/LandAerodrome> <http://api.nsgreg.nga.mil/ontology/regx/1.0/dateAccepted> "2016-10-
25T00:00:00Z"^^<http://www.w3.org/2001/XMLSchema#dateTime> .
```

Figure 10 – Individual Resource in N-Triples Encoding for Basic Term `LandAerodrome`

Annex A – Conformance

(Normative)

A.1 *Introduction*

Conformance is the fulfilment of specified requirements.[27] Conformance to the NSG Core Vocabulary (NCV) Standard shall be determined based on the tests specified in this Annex. Any product claiming conformance to the NCV Standard and corresponding NCV content shall pass all the requirements specified in the abstract test suite in Section A.2 (NSG Core Vocabulary). Conformance under special conditions is described in Section A.3 (vocabulary subsets) and Section A.4 (vocabulary extensions). Any product claiming conformance to the NSG vocabulary specification for a vocabulary defining non-NCV content shall pass all the requirements specified in the abstract test suite in Section A.5.

A general explanation of conformance testing for the NCV Standard is presented in this section, including relevant terminology. The conformance testing framework specified in Section A.2 is based on ISO 19105:2000 *Geographic information – Conformance and testing*. The definition of an abstract test suite for conformance testing appears in ISO 19105, together with an explanation of the testing framework. The format for conformance clauses is specified in ISO 19105, Annex A.

A.1.1 Terms and Definitions

A special terminology is used to describe the conformance testing framework. Terms that are defined in ISO 19105:2000 have a number in parentheses referring to the clause of that standard in which the term is defined.

[27] ISO 19105:2000 *Geographic information – Conformance and testing*.

Table 20 – Terms and Definitions for Conformance Testing

Term	Definition
abstract test case (ATC)	A generalized test for a particular requirement. (3.1) NOTE: An abstract test case is a formal basis for deriving executable test cases. One or more test purposes are encapsulated in the abstract test case. An abstract test case is independent of both the **implementation** and the values. It should be complete in the sense that it is sufficient to enable a test **verdict** to be assigned unambiguously to each potentially observable test outcome (*i.e*., sequence of test events).
abstract test module (ATM)	A set of related **abstract test cases**. (3.3) NOTE: Abstract test modules may be nested in a hierarchical way.
abstract test suite (ATS)	An **abstract test module** specifying all the requirements to be satisfied for **conformance**. (3.4)
basic test	An initial **capability test** intended to identify clear cases of non-conformance. (3.6) NOTE: Basic tests may be used to determine whether to conduct further tests.
capability test	A test designed to determine whether an **implementation** under test conforms to a particular characteristic of a standard as described in the test purpose. (3.7) NOTE: Capability tests check that the capabilities claimed in an **implementation conformance statement (ICS)** are consistent with the observable capabilities of the implementation under test.
conformance	The fulfilment of specified requirements. (3.8) NOTE: Conformance may be claimed for data or software or services or by specifications including any profile or functional standard. (1 - Scope)
conformance testing	The testing of a product to determine the extent to which the product is a conforming **implementation**. (3.11)
contains	Includes a representation of the content of the NSG Core Vocabulary. NOTE1: A **product** may contain the NCV content either directly (for example, by importing the NCV content in one of its two official encodings), or by reference (for example, by accessing NCV vocabulary terms as individual resources through the REST API component of the NSG Standards Registry). NOTE2: The representation included may be as a whole or in part, where use of a subset of the NCV content is permitted.
implementation	A realization of a specification. (3.18) NOTE: In the context of the ISO geographic information standards, this includes specifications of geographic information services and datasets.
implementation conformance statement (ICS)	A statement of the options which have been implemented. (3.19) NOTE: This will allow the **implementation** to be tested for **conformance** against the relevant requirements, and against those requirements only. This statement shall contain only options within the framework of requirements specified in the relevant geographic information standards.
product	Data or software or a service. (3.8)
verdict	The result of a test. (6.4.4) NOTE: The value of a test verdict is one of: *pass*, *fail*, or *inconclusive*. Verdict criteria are specified by an **abstract test case**.

A.1.2 Conformance Testing Methodology

Conformance testing for the NCV Standard is specified by this abstract test suite (ATS).

An ATS comprises all of the abstract test cases needed to produce an overall verdict about the conformance of a candidate product. Abstract test cases may be collected in a set of related tests called an abstract test module. Abstract test modules may be nested. An abstract test suite includes test modules and other test cases arranged in a hierarchy of conformance tests.

Each abstract test case is designed to test a candidate product for conformance to a specific requirement. A test case has several components:

a) A test-case identifier;

b) A stated test purpose that is a precise description of the test objective and also indicates whether the requirement being tested is mandatory, conditional, or optional;

c) A description of the test method, specifying the test criteria that shall be used to determine the test verdict. A test may evaluate a multi-part requirement. The method indicates the way in which the test shall be conducted (*e.g.*, manual or automated). The test method may reference other clauses in the test suite.

d) References to one or more sections in the standard that identify the requirements addressed by the test.

e) The test type (either a basic test or a capability test).

Mandatory requirements are those which shall be observed in all cases. Conditional requirements shall be observed if the conditions set out in the specification apply. Optional requirements may be selected to suit the implementation, provided that any requirements applicable to the option are observed.[28]

Abstract test cases may be automated for performance by a software system. Manual testing may be necessary when human judgment is required or when automated testing is too complex.

In addition to an ATS, testing requires an implementation conformance statement (ICS) that declares which capabilities have been implemented for the product. This is especially important when there are options that may be implemented (or not), in order to evaluate the conformance of a particular implementation against the relevant requirements. The ICS shall identify the edition of the NCV Standard to which the product claims conformance. Annex B provides ICS Pro Forma templates for the Conformance Classes described below.

Capability testing for the NCV Standard may occur in four situations, depending upon the class of conformance:

- Class A: Use of the complete NCV content.
- Class B: Use of an allowable subset of the NCV content.
- Class C: Use of the NCV content with allowable extensions.
- Class D: Use of the NSG vocabulary specification to define a vocabulary with non-NCV content.

Class A (Section A.2) of the Abstract Test Suite evaluates conformance of a product using the NCV content as a whole, that is, with all of the content specified in either the RDF/XML or N-Triples encoding. Class B specifies the conditions under which selective use of the NCV content conforms to the NCV Standard, and Class C specifies the conditions under which the NCV may be used with allowable extensions. Products that claim conformance to the NCV content (Classes A, B, or C) shall use the NCV content in one of the two official encodings (RDF/XML or N-Triples). The implementation conformance statement (ICS) for the product being tested shall identify a single NCV content baseline to be used by the implementation.

Class D (Section A.5) of the Abstract Test Suite evaluates the conformance of a vocabulary defining non-NCV content to the NSG vocabulary specification in Section 5 of this standard. A vocabulary that conforms to the NSG vocabulary specification conforms to the NSG vocabulary information model (Section 5.3) and vocabulary encoding guidance (Section 5.5), including IRI requirements.

A.1.3 Logical Structure of the Abstract Test Suite

The abstract test suite for the NCV Standard contains one top-level test case and five top-level test modules that contain multiple subordinate test modules and/or test cases. The structure of the test suite for Class A conformance is depicted in Figure 11. The structure of the test suite for Class D conformance is depicted in Figure 12. Elements of the structural diagrams for Class A and Class D are labeled using the test identifiers provided in the detailed

[28] ISO 19105:2000, Section 5.3.

specification of the ATS Classes presented in Annex A.[29] While the structures of Class A and Class D are similar, the specified test conditions differ in accordance with the different scope of the two conformance classes.

The conditions for Class B and Class C conformance are stated in Section A.3 and Section A.4, respectively.

[29] In Annex A, the numbering of specifications for Class A and Class D test modules and/or test cases follows the top-level arrangement of the structural diagram (top-to-bottom, then left-to-right), with subsections for nested test modules and/or test cases.

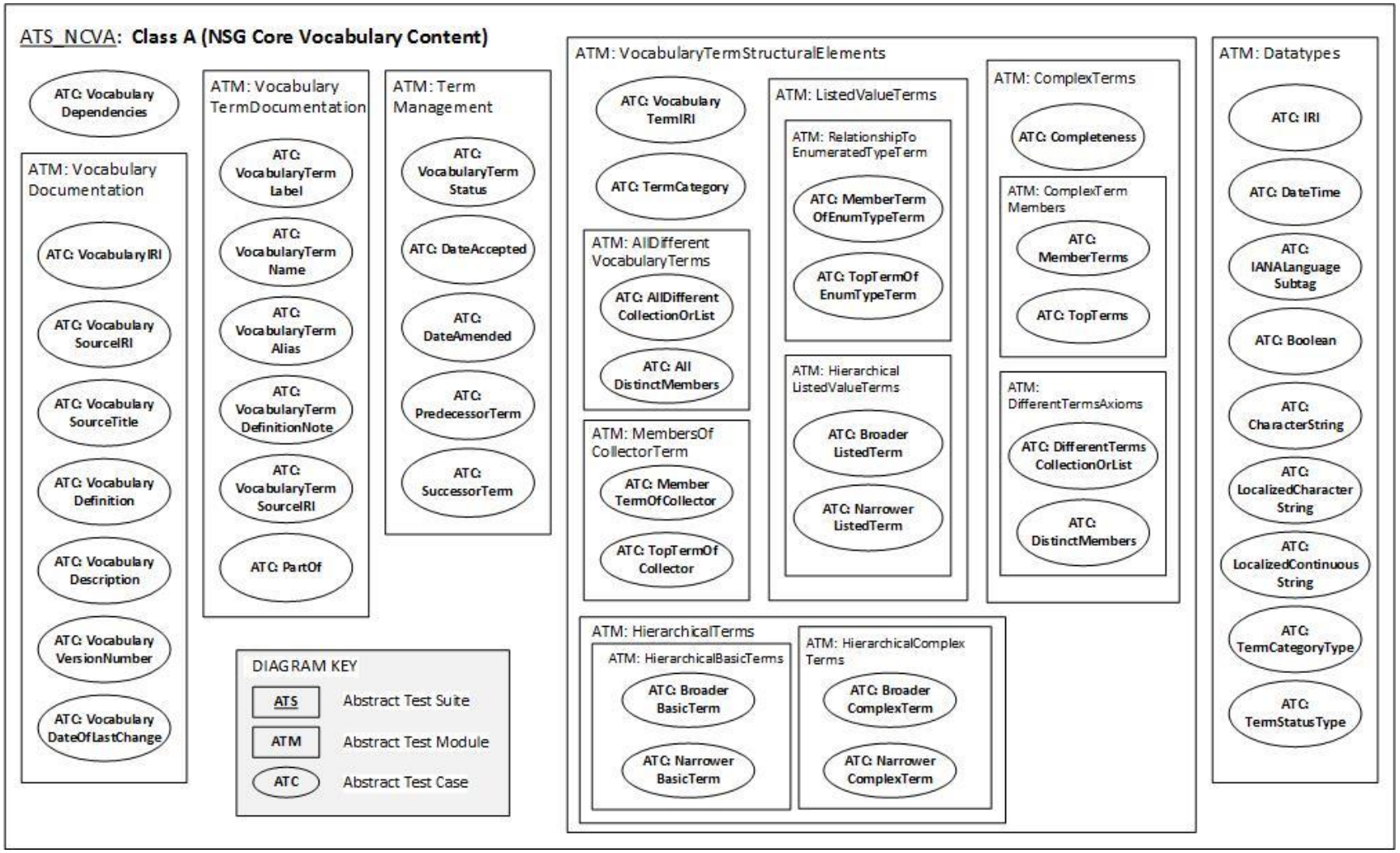


Figure 11 – Structure of the Abstract Test Suite for Conformance to the NSG Core Vocabulary Content (Class A)

A.2 *Abstract Test Suite for Conformance to the NSG Core Vocabulary Content (Class A)*

a) Test identifier: ATS_NCVA

b) Test purpose: Verify the conformance of the product with the NSG Core Vocabulary (NCV) content specified in the NCV Standard and accompanying technical artifacts. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required vocabulary dependencies (A.2.1), vocabulary documentation (A.2.2), vocabulary term structural elements (A.2.3), vocabulary term documentation (A.2.4), vocabulary term-management information (A.2.5), and required datatypes (A.2.6), in accordance with the requirements of the NCV vocabulary specification.

d) Reference: NCV Standard, Section 5, and NCV technical artifacts (Section 6.2.3).

NOTE: The implementation conformance statement (ICS) for the product being tested shall specify a single NCV content baseline to be used by the implementation.

e) Test type: Basic

NOTE: If an information construct from the NCV is employed within a product, then the meaning and structure of the construct shall be preserved, and information regarding the corresponding construct shall be exactly as specified in the NCV Standard and its accompanying technical artifacts.

A.2.1 Test Case for Vocabulary Dependencies

a) Test identifier: VocabularyDependencies

b) Test purpose: Verify the conformance of the product with all dependencies in the NCV content baseline. (**Mandatory**)

c) Test method: Inspect the product to determine that it correctly identifies all elements from external namespaces or schemas used in the NCV baseline encoding(s).

1) (RDF/XML encoding) The NCV content shall contain namespace declarations and namespace abbreviations (for example: ‘skos’, ‘dct’, ‘xml’, ‘ncvx’) for all elements from external namespaces, including for required elements of the vocabulary information model.

2) (N-Triples encoding) The NCV content shall correctly reference the full URIs for all elements from external namespaces, including for required elements of the vocabulary information model.

d) Reference: NCV Standard (Section 5.5; Annex D).

e) Test type: Basic

A.2.2 Test Module for Vocabulary Documentation

a) Test identifier: VocabularyDocumentation

b) Test purpose: Verify the conformance of the product with the documentation required for the NCV content. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required vocabulary documentation information with the correct values for the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.4.4; Section 5.5.3).

e) Test type: Basic

A.2.2.1 Test Case for Vocabulary Identifier

a) Test identifier: VocabularyIRI

b) Test purpose: Verify the conformance of the product with the documentation of the identifier for the specified NCV content baseline. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required namespace documentation with the IRI for the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.4.4 (item 1); Section 5.5.3 (Figure 4 and Table 16 (row 2))).

e) Test type: Basic

A.2.2.2 Test Case for Vocabulary Source IRI

a) Test identifier: VocabularySourceIRI

b) Test purpose: Verify the conformance of the product with documentation of the IRI for the NCV Standard document on which the NCV content baseline is based. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required documentation of the IRI for the NCV Standard document specified in the ICS.

d) Reference: NCV Standard (Section 5.4.4 (item 2); Section 5.5.3 (Figure 4 and Table 16 (row 7))).

e) Test type: Basic

A.2.2.3 Test Case for Vocabulary Source Title

a) Test identifier: VocabularySourceTitle

b) Test purpose: Verify the conformance of the product with the documentation of the title of the NCV Standard document on which the NCV content baseline is based. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required documentation of the title of the NCV Standard document specified in the ICS.

d) Reference: NCV Standard (Section 5.4.4 (item 2); Section 5.5.3 (Figure 4 and Table 16 (row 8))).

e) Test type: Basic

A.2.2.4 Test Case for Vocabulary Definition

a) Test identifier: VocabularyDefinition

b) Test purpose: Verify the conformance of the product with documentation of the definition for the NSG Core Vocabulary. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required documentation of the definition for the NCV as in the content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.4.4 (item 3); Section 5.5.3 (Figure 4 and Table 16 (row 10))).

e) Test type: Basic

A.2.2.5 Test Case for Vocabulary Description

a) Test identifier: VocabularyDescription

b) Test purpose: Verify the conformance of the product with documentation of the description for the NSG Core Vocabulary. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required documentation of the description for the NCV as in the content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.4.4 (item 4); Section 5.5.3 (Figure 4 and Table 16 (row 10))).

e) Test type: Basic

A.2.2.6 Test Case for Vocabulary Version Number

a) Test identifier: VocabularyVersionNumber

b) Test purpose: Verify that a product which uses the NCV content encoding from a registered NCV technical artifact (*i.e.*, either a designated version or generic baseline) has documented the version number of that unique technical artifact and conforms to its content. (Conditional)

c) Test method: Inspect the product to determine that it contains the version number of the registered NCV technical artifact specified in the ICS, and compare the NCV content contained in the product with the specified version.

d) Reference: NCV Standard (Section 5.4.4 (item 5); Section 5.5.3 (Figure 4 and Table 16 (row 3))).

e) Test type: Basic

A.2.2.7 Test Case for Vocabulary Date of Last Change

a) Test identifier: VocabularyDateOfLastChange

b) Test purpose: Verify that a product which accesses the NCV content encoding through the REST API component of the NSG Standards Registry has documented the date of last change for that unique content encoding and conforms to its content. (Conditional)

c) Test method: Inspect the product to determine that it indicates the date of last change for the NCV resource retrieved from the REST API resource specified in the ICS, and compare the NCV content contained in the product with the content of the specified REST API resource.

d) Reference: NCV Standard (Section 5.4.4 (item 6); Section 5.5.3 (Figure 5 and Table 16 (row 9))).

e) Test type: Basic

A.2.3 Test Module for VocabularyTerm Documentation

a) Test identifier: VocabularyTermDocumentation

b) Test purpose: Verify the conformance of the product with the required documentation properties for each VocabularyTerm as specified in the NSG vocabulary specification. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required documentation properties with the correct values for each VocabularyTerm in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3, Section 5.5.4.2, Section 5.5.4.3)

e) Test type: Basic

A.2.3.1 Test Case for Conformance to VocabularyTerm Label

a) Test identifier: VocabularyTermLabel

b) Test purpose: Verify the conformance of the product with the documentation of the label for each VocabularyTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each VocabularyTerm has the required documentation property (`rdfs:label`) with the value as specified in the NCV content baseline specified in the ICS. The value is the same as the terminal component of the VocabularyTerm IRI.

d) Reference: NCV Standard (Section 5.5.4.2 (Table 17 (row 3)), Section 5.5.4.3 (Table 18 (row 3)))

e) Test type: Basic

A.2.3.2 Test Case for VocabularyTerm Name

a) Test identifier: VocabularyTermName

b) Test purpose: Verify the conformance of the product with documentation of the name for each VocabularyTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each VocabularyTerm has the required documentation property (`skos:prefLabel`) with the value for the preferred human-readable name of the vocabulary term as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.5.4.2 (Table 17 (row 4)), Section 5.5.4.3 (Table 18 (row 4)))

e) Test type: Basic

NOTE: The preferred human-readable name of the VocabularyTerm shall be used to refer to that class in navigation menus, browse trees, and other displays.

A.2.3.3 Test Case for VocabularyTerm Alias

a) Test identifier: VocabularyTermAlias

b) Test purpose: Verify the conformance of the product with documentation of the optional alias(es), if any, for each VocabularyTerm. (Conditional)

c) Test method: Inspect the product to determine that each VocabularyTerm has the documentation property (`skos:altLabel`) with the value(s) specified (if any) in the NCV content baseline specified in the ICS.

NOTE: *Alias* is an optional element of the NSG vocabulary specification.

d) Reference: NCV Standard (Section 5.5.4.2 (Table 17 (row 5)), Section 5.5.4.3 (Table 18 (row 5)))

e) Test type: Basic

A.2.3.4 Test Case for VocabularyTerm Definition Note

a) Test identifier: VocabularyTermDefinitionNote

b) Test purpose: Verify the conformance of the product with documentation of the required definitionNote for each VocabularyTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each VocabularyTerm has the required documentation property (`skos:definition`) with the value as specified in the NCV content baseline as specified in the ICS.

d) Reference: NCV Standard (Section 5.5.4.2 (Table 17 (row 6)), Section 5.5.4.3 (Table 18 (row 6)))

e) Test type: Basic

A.2.3.5 Test Case for Vocabulary Term Source IRI

a) Test identifier: VocabularyTermSourceIRI

b) Test purpose: Verify the conformance of the product with documentation of the required sourceIRI for each VocabularyTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each VocabularyTerm has the required documentation property (`rdfs:isDefinedBy`) with the value specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.5.4.2 (Table 17 (row 7)), Section 5.5.4.3 (Table 18 (row 7)))

e) Test type: Basic

A.2.3.6 Test Case for Part-of

a) Test identifier: PartOf

b) Test purpose: Verify the conformance of the product with the required use of `dct:isPartOf` declarations. (Conditional on a product that represents an encoding for each individual VocabularyTerm in a separate resource file)

c) Test method: Inspect the product to determine that in each individual resource file, the VocabularyTerm has the documentation property `dct:isPartOf` with the value of the IRI for the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 6.2.4)

e) Test type: Basic

A.2.4 Test Module for Term Management

a) Test identifier: TermManagement

b) Test purpose: Verify the conformance of the product with the metadata attribution required for management of the controlled VocabularyTerms. (**Mandatory**)

c) Test method: Inspect the product to determine that VocabularyTerms have the required annotation properties and term relationships for documenting vocabulary management, as specified in the NSG vocabulary information model, with values as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Basic

A.2.4.1 Test Case for VocabularyTerm Status

a) Test identifier: VocabularyTermStatus

b) Test purpose: Verify the conformance of the product with the requirement that each VocabularyTerm shall have a declaration of its status. (**Mandatory**)

c) Test method: Inspect the product to determine whether each VocabularyTerm has the required termStatus property indicating whether it is 'valid', 'superseded', or 'retired', with the value specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 9)), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Basic

A.2.4.2 Test Case for Date Accepted

a) Test identifier: DateAccepted

b) Test purpose: Verify the conformance of the product with the requirement that each VocabularyTerm shall have a declaration of the date on which it was accepted into the vocabulary content. (**Mandatory**)

c) Test method: Inspect the product to determine whether each VocabularyTerm has the required dateAccepted property, with the date value in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 10)), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Basic

A.2.4.3 Test Case for Date Amended

a) Test identifier: DateAmended

b) Test purpose: Verify the conformance of the product with the conditional requirement that if a VocabularyTerm has been retired or superseded, then that VocabularyTerm shall have a declaration of the date on which it was thus amended. (Conditional)

c) Test method: Inspect the product to determine whether each VocabularyTerm having a termStatus of 'retired' or 'superseded' has a dateAmended property, with the date value specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 11)), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Basic

A.2.4.4 Test Case for Predecessor Term

a) Test identifier: PredecessorTerm

b) Test purpose: Verify the conformance of the product with the requirement that, for each term that has superseded another VocabularyTerm in the NCV, a unique predecessor relation to the VocabularyTerm that it replaced shall also be declared. (Conditional)

c) Test method: Inspect the product to determine whether, for each VocabularyTerm that is the successor (object) in a successorTerm relationship, that VocabularyTerm is also declared to have (as subject) the inverse predecessorTerm relationship to the VocabularyTerm that it replaced, as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 12)), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Capability test

A.2.4.5 Test Case for Successor Term

a) Test identifier: SuccessorTerm

b) Test purpose: Verify the conformance of the product with the requirement that, for each superseded VocabularyTerm in the NCV, a successorTerm relation to the VocabularyTerm that replaced it shall be declared. (Conditional)

c) Test method: Inspect the product to determine whether, for each VocabularyTerm that has a termStatus value of 'superseded' in the NCV content baseline specified in the ICS, there is also declared a successorTerm relationship to the VocabularyTerm that replaced the superseded term.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 13)), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Capability test

A.2.5 Test Module for VocabularyTerm Structural Elements

a) Test identifier: VocabularyTermStructuralElements

b) Test purpose: Verify the conformance of the product with the required NSG vocabulary structural elements. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the applicable structural elements, including vocabulary term identifiers (A.2.5.1), vocabulary term categories (A.2.5.2), (optional) axiom declaring all vocabulary terms distinct (A.2.5.3), member relationships to collectors (A.2.5.4), hierarchical term relationships (A.2.5.5), listed value terms (A.2.5.6), and complex vocabulary terms (A.2.5.7), as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3, Section 5.5.2, and Section 5.5.4)).

e) Test type: Basic

A.2.5.1 Test Case for VocabularyTerm Identifiers

a) Test identifier: VocabularyTermIRI

b) Test purpose: Verify the conformance of the product with all of the specified identifiers for the NCV VocabularyTerms as established by IRIs in the NCV namespace (http://api.nsgreg.nga.mil/vocabulary/ncv). (**Mandatory**)

c) Test method: Inspect the product to determine that it contains all of the correct IRI values in the NCV namespace for all NCV VocabularyTerms in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.5.2)

e) Test type: Basic

A.2.5.2 Test Case for VocabularyTerm Category

a) Test identifier: TermCategory

b) Test purpose: Verify the conformance of the product with the requirement that every vocabulary term shall be an instance of a concrete subclass of *VocabularyTerm* as indicated by its term category. (**Mandatory**)

c) Test method: Inspect the product to determine that every vocabulary term has the property termCategory (`ncvx:termCategory`) with one of the following values: [for terms encoded with `ncvx:BasicVocabularyTerm`] 'entity', 'attribute', or 'listedValue'; or [for terms encoded using `ncvx:ComplexVocabularyTerm`] 'collector' or 'enumeratedType', as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 8)), Section 5.3.4 (Constraints in Tables 7-11), Section 5.3.6.8)

e) Test type: Capability test

A.2.5.3 Test Module for Distinct VocabularyTerms

a) Test identifier: AllDifferentVocabularyTerms

b) Test purpose: Verify the conformance of the product with an optional assertion of an axiom declaring that all the VocabularyTerms in the vocabulary are pairwise distinct. (Conditional)

NOTE: The meanings of vocabulary terms that are members of a DifferentTermsAxiom may overlap (as in the case of ListedValueTerms that are hierarchical terms belonging to the same EnumeratedTypeTerm); however, member terms of a DifferentTermsAxiom shall not be identical in meaning with each other.

c) Test method: Inspect the product to determine that if the NCV content baseline specified in the ICS contains a DifferentTermsAxiom applicable to all vocabulary terms in the NCV content, then that axiom is properly represented in the applicable encoding format.

d) Reference: NCV Standard (Section 5.3.5, Section 5.5.4.4 (Table 19))

e) Test type: Basic test

A.2.5.3.1 Test Module for DifferentTerms Collection or List

a) Test identifier: AllDifferentCollectionOrList

b) Test purpose: Verify the conformance of the product with an optional declaration that all VocabularyTerms in the vocabulary are pairwise distinct. (Conditional)

c) Test method: Inspect the product to determine whether it contains exactly one DifferentTerms class axiom (using `owl:AllDifferent`) whose declared members are all the VocabularyTerms in the in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.5 (Table 12 (row 1)), Section 5.5.4.4 (Table 19 (row 1)))

e) Test type: Capability test

A.2.5.3.2 Test Module for DistinctMembers

a) Test identifier: AllDistinctMembers

b) Test purpose: Verify the conformance of the product with an optional declaration that all VocabularyTerms in the vocabulary are pairwise distinct in meaning. (Conditional)

c) Test method: Inspect the product to determine that each VocabularyTerm in the NCV content baseline specified in the ICS is included as a member in the DifferentTerms class axiom declaring all terms in the vocabulary content to be pairwise distinct.

d) Reference: NCV Standard (Section 5.3.5 (Table 12 (row 2)), Section 5.5.4.4 (Table 19 (row 2)))

e) Test type: Capability test

A.2.5.4 Test Module for Members of CollectorTerm

a) Test identifier: MembersOfCollectorTerm

b) Test purpose: Verify the conformance of the product with the requirement that each EntityTerm or AttributeTerm that belongs to a CollectorTerm shall have a member-term-of and (if applicable) a top-term-of relationship to that CollectorTerm. (**Mandatory**)

c) Test method: Inspect the product to determine whether each EntityTerm and AttributeTerm in the NCV content baseline specified in the ICS that belongs to a CollectorTerm(s) has the required membership relationships (A.2.5.5.1 and A.2.5.5.2).

d) Reference: NCV Standard (Section 5.3.4 (Constraints in Tables 7-8), Section 5.5.4.2 (Table 17))

e) Test type: Capability test

A.2.5.4.1 Test Case for Member Term of CollectorTerm

a) Test identifier: MemberTermOfCollector

b) Test purpose: Verify the conformance of the product with the requirement that each EntityTerm or AttributeTerm that belongs to a CollectorTerm shall have a member-term-of relationship to that CollectorTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each EntityTerm or AttributeTerm that belongs to a CollectorTerm has the required member-term-of relationship (using `skos:inScheme`), as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 4)), Section 5.5.4.2 (Table 17 (row 16)))

e) Test type: Capability test

A.2.5.4.2 Test Case for Top Term of CollectorTerm

a) Test identifier: TopTermOfCollector

b) Test purpose: Verify the conformance of the product with the requirement that if an EntityTerm or AttributeTerm is a member of a CollectorTerm and has no broader term that is a member of the same CollectorTerm, then that EntityTerm or AttributeTerm shall have a top-term-of relationship to that CollectorTerm. (Conditional)

c) Test method: Inspect the product to determine that each EntityTerm or AttributeTerm which is a member of a CollectorTerm and has no broader term that is a member of the same CollectorTerm is asserted to have a top-term-of relationship to that CollectorTerm in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 5)), Section 5.5.4.2 (Table 17 (row 17), Section 5.3.4 (Constraints in Tables 7-8))

e) Test type: Capability test

A.2.5.5 Test Module for Hierarchical Term Relationships

a) Test identifier: HierarchicalTerms

b) Test purpose: Verify the conformance of the product with the requirement that every vocabulary term which has a hierarchical (broader or narrower) relationship(s) with another vocabulary term shall be related by the appropriate relationship only to a vocabulary term(s) of the same term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether every vocabulary term which has a hierarchical relationship to another vocabulary term is related by the appropriate relationship only to a term(s) that has the same value of term category, as specified in the NCV content baseline specified in the ICS.

NOTE: This test module is applied only to EntityTerms and AttributeTerms. All ListedValueTerms having hierarchical relationships are evaluated in the Test Module for ListedValueTerms (Section A.2.5.6).

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (rows 2-3 and Constraints 1-2)), Section 5.5.4.2 (Table 17 (row 8; rows 14-15)), Section 5.3.3 (Table 6 (rows 4-5 and Constraints 3-4)), Section 5.5.4.3 (Table 18 (row 8; rows 15-16), Section 5.3.6.8)

e) Test type: Capability test

A.2.5.5.1 Test Module for Hierarchical Basic Terms

a) Test identifier: HierarchicalBasicTerms

b) Test purpose: Verify the conformance of the product with the requirement that every basic vocabulary term which has a hierarchical (broader or narrower) relationship(s) with another term shall be related only to a basic vocabulary term(s) of the same term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each basic vocabulary term which has a hierarchical (broader or narrower) relationship is related only to another basic vocabulary term(s) having the same value of term category, as specified in the NCV content baseline specified in the ICS.

NOTE: This test module is applied only to EntityTerms and AttributeTerms. All ListedValueTerms having hierarchical relationships are evaluated in the Test Module for ListedValueTerms (Section A.2.5.6).

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (rows 2-3 and Constraints 1-2)), Section 5.5.4.2 (Table 17 (row 8; rows 14-15)), Section 5.3.6.8)

e) Test type: Capability test

A.2.5.5.1.1 Test Case for Broader Basic Term

a) Test identifier: BroaderBasicTerm

b) Test purpose: Verify the conformance of the product with the requirement that every basic vocabulary term which has a broader-term relationship to another vocabulary term shall be related only to a basic vocabulary term having the same value of term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each basic vocabulary term which has a broader-term relationship to another vocabulary term has the same value of term category as the broader term, as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 2 and Constraint 1)), Section 5.5.4.2 (Table 17 (rows 8 and 14)), Section 5.3.6.8)

e) Test type: Capability test

A.2.5.5.1.2 Test Case for Narrower Basic Term

a) Test identifier: NarrowerBasicTerm

b) Test purpose: Verify the conformance of the product with the requirement that every basic vocabulary term which has a narrower-term relationship to another vocabulary term shall be related only to a basic vocabulary term having the same value of term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each basic vocabulary term which has a narrower-term relationship to another vocabulary term has the same value of term category as the broader term, as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 3 and Constraint 2)), Section 5.5.4.2 (Table 17 (rows 8 and 15)), Section 5.3.6.8)

e) Test type: Capability test

A.2.5.5.2 Test Module for Hierarchical Complex Terms

a) Test identifier: HierarchicalComplexTerms

b) Test purpose: Verify the conformance of the product with the requirement that every complex vocabulary term which has a hierarchical (broader or narrower) relationship(s) with another term shall be related only to a complex vocabulary term(s) of the same term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each complex vocabulary term which has a hierarchical (broader or narrower) relationship is related only to another complex vocabulary term(s) having the same value of term category, as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (rows 4-5 and Constraints 3-4)), Section 5.5.4.2 (Table 18 (row 8; rows 16-17)), Section 5.3.6.8)

e) Test type: Capability test

A.2.5.5.2.1 Test Case for Broader Complex Term

a) Test identifier: BroaderComplexTerm

b) Test purpose: Verify the conformance of the product with the requirement that every complex vocabulary term which has a broader-term relationship to another vocabulary term shall be related only to a complex vocabulary term having the same value of term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each complex vocabulary term which has a broader-term relationship to another vocabulary term has the same value of term category as the broader term, as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (row 4 and Constraint 3)), Section 5.5.4.2 (Table 18 (rows 8 and 16)), Section 5.3.6.8)

e) Test type: Capability test

A.2.5.5.2.2 Test Case for Narrower Complex Term

a) Test identifier: NarrowerComplexTerm

b) Test purpose: Verify the conformance of the product with the requirement that every complex vocabulary term which has a narrower-term relationship to another vocabulary term shall be related only to a complex vocabulary term having the same value of term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each complex vocabulary term which has a narrower-term relationship to another vocabulary term has the same value of term category as the narrower term, as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (row 4 and Constraint 4)), Section 5.5.4.2 (Table 18 (rows 8 and 17)), Section 5.3.6.8)

e) Test type: Capability test

A.2.5.6 Test Module for ListedValueTerms

a) Test identifier: ListedValueTerms

b) Test purpose: Verify the conformance of the product with the required structural elements for ListedValueTerms. (**Mandatory**)

c) Test method: Inspect the product to determine that each ListedValueTerm has the required membership relationship(s) to exactly one EnumeratedTypeTerm (A.2.5.6.1), and, if applicable, that it has any hierarchical relationships to other ListedValueTerms (A.2.5.6.2), as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5), Section 5.3.4 (Constraints in Table 9), Section 5.5.4.2 (Table 17))

e) Test type: Capability test

A.2.5.6.1 Test Module for Relationships to EnumeratedTypeTerm

a) Test identifier: RelationshipToEnumeratedTypeTerm

b) Test purpose: Verify the conformance of the product with the requirement that each ListedValueTerm shall belong to exactly one EnumeratedTypeTerm and, if applicable, shall be a top term of the same EnumeratedTypeTerm. (**Mandatory**)

c) Test method: Inspect the product to determine whether each ListedValueTerm has the membership relationship to exactly one EnumeratedTypeTerm, and, if applicable, has a top term relationship to the same EnumeratedTypeTerm (A.2.5.6.1.1 and A.2.5.6.1.2), as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5), Section 5.3.4 (Constraints in Table 9), Section 5.5.4.2 (Table 17))

e) Test type: Capability test

A.2.5.6.1.1 Test Case for Member Term of EnumeratedTypeTerm

a) Test identifier: MemberTermOfEnumTypeTerm

b) Test purpose: Verify the conformance of the product with the requirement that each ListedValueTerm shall belong to exactly one EnumeratedTypeTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each ListedValueTerm has a member-term-of relationship (using `skos:inScheme`) to exactly one EnumeratedTypeTerm, as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 4)), Section 5.3.4 (Constraints 2-3 in Table 9), Section 5.5.4.2 (Table 17 (row 16)))

e) Test type: Capability test

A.2.5.6.1.2 Test Case for Top Term of EnumeratedTypeTerm

a) Test identifier: TopTermOfEnumTypeTerm

b) Test purpose: Verify the conformance of the product with the requirement that if a ListedValueTerm is a member of an EnumeratedTypeTerm and has no broader term that is a member of the same EnumeratedTypeTerm, then that ListedValueTerm shall have a top-term-of relationship to that EnumeratedTypeTerm. (Conditional)

c) Test method: Inspect the product to determine that each ListedValueTerm which is a member of an EnumeratedTypeTerm and has no broader term that is a member of the same EnumeratedTypeTerm is asserted to have a top-term-of relationship to that EnumeratedTypeTerm, as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 5)), Section 5.3.4 (Constraint 4 in Table 9), Section 5.5.4.2 (Table 17 (row 17)))

e) Test type: Capability test

A.2.5.6.2 Test Module for Hierarchical Relationships Between ListedValueTerms

a) Test identifier: HierarchicalListedValueTerms

b) Test purpose: Verify the conformance of the product with the requirement that a ListedValueTerm that is a member of an EnumeratedTypeTerm representing a hierarchical set of listed values shall have broader-term and narrower-term relationships (if applicable) with one or more other ListedValueTerms that are members of the same EnumeratedTypeTerm. (Conditional)

c) Test method: Inspect the product to determine whether the ListedValueTerm is a member of an EnumeratedTypeTerm that represents a hierarchical set of listed values; if so, then determine whether the ListedValueTerm has a broader-term relationship (A.2.5.4.2.1) and/or narrower-term relationship(s) (A.2.5.4.2.2) to other ListedValueTerm(s) in the same EnumeratedTypeTerm.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (rows 2-4)), Section 5.5.4.2 (Table 17 (rows 14-16))

e) Test type: Capability test

A.2.5.6.2.1 Test Case for Broader Terms

a) Test identifier: BroaderListedTerm

b) Test purpose: Verify the conformance of the product with the requirement that a broader-term relationship be declared for each ListedValueTerm that is a narrower term of another ListedValueTerm. (Conditional)

c) Test method: Inspect the product to determine whether the ListedValueTerm being tested is a member of an EnumeratedTypeTerm that represents a hierarchical domain of values; if so, then that ListedValueTerm should have a broader-term relationship to another ListedValueTerm that is a member of that EnumeratedTypeTerm, unless the ListedValueTerm being tested is a “top term” of the EnumeratedTypeTerm, in which case it has only narrower-term relationships (see A.2.5.4.2.2)

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 2 and Constraint 1)), Section 5.5.4.2 (Table 17 (row 14)))

e) Test type: Capability test

A.2.5.6.2.2 Test Case for Narrower Terms

a) Test identifier: NarrowerListedTerm

b) Test purpose: Verify the conformance of the product with the requirement that a narrower-term relationship be declared for each ListedValueTerm that is a broader term of another ListedValueTerm. (Conditional)

c) Test method: Inspect the product to determine whether the ListedValueTerm being tested is a broader term for another ListedValueTerm; if so, then the ListedValueTerm being tested should be declared to have a narrower-term (*i.e.*, inverse) relationship to that other ListedValueTerm.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 3 and Constraint 2)), Section 5.5.4.2 (Table 17 (row 15)))

e) Test type: Capability test

A.2.5.7 Test Module for ComplexVocabularyTerms

a) Test identifier: ComplexTerms

b) Test purpose: Verify the conformance of the product with the required structural properties for vocabulary terms having the term category of CollectorTerm or EnumeratedTypeTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each CollectorTerm and EnumeratedTypeTerm has the required structural elements.

d) Reference: NCV Standard (Section 5.3.3 (Table 6), Section 5.3.5 (Table 12), Section 5.5.4.3 (Table 18), Section 5.5.4.4 (Table 19))

e) Test type: Capability test

A.2.5.7.1 Test Case for ComplexVocabularyTerm Completeness

a) Test identifier: Completeness

b) Test purpose: Verify the conformance of the product with the requirement that each ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) be declared as representing either a complete (*i.e.*, closed and non-extensible) or incomplete (*i.e.*, open and extensible) domain of VocabularyTerms. (**Mandatory**)

c) Test method: Inspect the product to determine that (1) each CollectorTerm (collection of EntityTerms and/or AttributeTerms) has the Boolean attribute domainComplete (`ncvx:domainComplete`) declared with either the value 'TRUE' (if the collection is complete) or the value 'FALSE' (if the collection is open); and (2) each EnumeratedTypeTerm (collection of ListedValueTerms) has the Boolean attribute domainComplete (`ncvx:domainComplete`) declared with either the value 'TRUE' (if the collection is complete) or the value 'FALSE' (if the collection is open), each as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (row 2)), Section 5.5.4.3 (Table 18 (row 14)))

e) Test type: Basic test

A.2.5.7.2 Test Module for ComplexVocabularyTerm Members

a) Test identifier: ComplexTermMembers

b) Test purpose: Verify the conformance of the product with the requirement that every ComplexVocabularyTerm be declared to have one or more BasicVocabularyTerms of the appropriate type(s) as members, with a subset of those as top terms. (**Mandatory**)

c) Test method: Inspect the product to determine whether each ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) in the NCV content baseline specified in the ICS has one or more BasicVocabularyTerms of the appropriate type(s) declared as members, and a subset of those declared as top terms. (1) Each member of a CollectorTerm shall be either an EntityTerm or an AttributeTerm. (2) Each member of an EnumeratedTypeTerm shall be a ListedValueTerm.

NOTE: The set of top terms is not required to be a proper subset of the member terms. In the case of a ComplexVocabularyTerm for which no member vocabulary term has a broader term that is also a member of the ComplexVocabularyTerm, all member vocabulary terms are declared to be top terms.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (row 3 and Constraint 1)), Section 5.3 (Table 10 (Constraint 2), Table 11 (Constraint 2), Section 5.5.4.3 (Table 18 (row 15)), Section A.2.5.4.1, Section A.2.5.6.1.1)

e) Test type: Capability test

A.2.5.7.2.1 Test Case for Member Terms

a) Test identifier: MemberTerms

b) Test purpose: Verify the conformance of the product with the requirement that every ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) be declared to have one or more BasicVocabularyTerms (AttributeTerm, EntityTerm, or ListedValueTerm) as members. (**Mandatory**)

c) Test method: Inspect the product to determine whether (1) each CollectorTerm has one or more EntityTerms and/or AttributeTerms declared as its members; and (2) each EnumeratedTypeTerm has one or more ListedValueTerms declared as its members, using `skos:inScheme`, as specified in the NCV content baseline specified in the ICS.

NOTE: The membership relationship between a ComplexVocabularyTerm and a BasicVocabularyTerm is a unidirectional association represented from the member term to the complex term. (See Section A.2.5.4.1 and Section A.2.5.6.1.1)

d) Reference: NCV Standard (Section A.2.5.4.1, Section A.2.5.6.1.1)

e) Test type: Capability test

A.2.5.7.2.2 Test Case for Top Terms

a) Test identifier: TopTerms

b) Test purpose: Verify the conformance of the product with the requirement that every ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) be declared to have one or more BasicVocabularyTerms (AttributeTerm, EntityTerm, or ListedValueTerm) of the appropriate type(s) as top terms. (**Mandatory**)

c) Test method: Inspect the product to determine whether (1) each CollectorTerm has one or more EntityTerms and/or AttributeTerms declared to be a top term of the CollectorTerm, and (2) each EnumeratedTypeTerm has one or more ListedValueTerms declared to be a top term of the EnumeratedTypeTerm, using `skos:hasTopConcept`, as specified in the NCV content baseline specified in the ICS; also, (3) each top term of a ComplexVocabularyTerm has no broader term that is also a member of that ComplexVocabularyTerm.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (row 3)), Section 5.5.4.3 (Table 18 (row 15)))

e) Test type: Capability test

A.2.5.7.3 Test Module for DifferentTerms Axioms

a) Test identifier: DifferentTermsAxioms

b) Test purpose: Verify the conformance of the product with the requirement that for every EnumeratedTypeTerm, there shall be an axiom declaring that all member ListedValueTerms of that EnumeratedTypeTerm are distinct from each other. (**Mandatory**)

NOTE: The meanings of BasicVocabularyTerms that are members of a ComplexVocabularyTerm may overlap (as in the case of ListedValueTerms that are hierarchical terms belonging to the same EnumeratedTypeTerm); however, member terms of a ComplexVocabularyTerms shall not be identical in meaning with each other.

c) Test method: Inspect the product to determine that the set of members of each ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) has a DifferentTerms axiom properly represented in the applicable encoding format.

d) Reference: NCV Standard (Section 5.3.5 (Table 12), Section 5.5.4.4 (Table 19))

e) Test type: Basic test

A.2.5.7.3.1 Test Module for DifferentTerms Collection or List

a) Test identifier: DifferentTermsCollectionOrList

b) Test purpose: Verify the conformance of the product with the requirement to declare an axiom for every ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) to indicate that all BasicVocabularyTerms belonging to the same ComplexVocabularyTerm are pairwise distinct. (**Mandatory**)

c) Test method: Inspect the product to determine whether every ComplexVocabularyTerm has a corresponding DifferentTerms (`owl:AllDifferent`) axiom whose declared members are exactly the members declared for that ComplexVocabularyTerm, as specified in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.5 (Table 12 (row 1)), Section 5.5.4.4 (Table 19 (row 1)))

e) Test type: Capability test

A.2.5.7.3.2 Test Module for DistinctMembers

a) Test identifier: DistinctMembers

b) Test purpose: Verify the conformance of the product with the requirement that all BasicVocabularyTerms that are members of the same ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) shall be declared to be distinct in meaning. (**Mandatory**)

c) Test method: Inspect the product to determine that every BasicVocabularyTerm belonging to (using `skos:inScheme`) a ComplexVocabularyTerm is included in the corresponding DifferentTerms axiom for that ComplexVocabularyTerm.

d) Reference: NCV Standard (Section 5.3.5 (Table 12 (row 2)), Section 5.5.4.4 (Table 19 (row 2)))

e) Test type: Capability test

A.2.6 Test Module for Datatype Conformance

a) Test identifier: Datatypes

b) Test purpose: Verify the conformance of the product with the datatypes specified in the NSG vocabulary information model. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses the required datatypes and encodings for IRIs (A.2.6.1), DateTime (A.2.6.2), IANALanguageSubtag (A.2.6.3), Boolean (A.2.6.4), CharacterString (A.2.6.5), LocalizedCharacterString (A.2.6.6), LocalizedContinuousString (A.2.6.7), TermCategoryType (A.2.6.8), and TermStatusType (A.2.6.9) value types specified in the vocabulary specification in the NCV Standard as used in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.6, Section 5.5.5, and Section 5.5.6)

e) Test type: Basic

A.2.6.1 Test Case for IRI Datatype

a) Test identifier: IRI

b) Test purpose: Verify the conformance of the product with the IRI datatype. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses values in the range of the required datatype `xsd:anyURI` for properties specified with the value type IRI in the NSG vocabulary information model and used in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.6.1, Section 5.5.5)

e) Test type: Basic

A.2.6.2 Test Case for DateTime Datatype

a) Test identifier: DateTime

b) Test purpose: Verify the conformance of the product with the DateTime datatype. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses values in the range of the required datatype `xsd:dateTime` for properties specified with the value type DateTime in the NSG vocabulary information model and used in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.6.2, Section 5.5.5)

e) Test type: Basic

A.2.6.3 Test Case for IANA Language Subtag

a) Test identifier: IANALanguageSubtag

b) Test purpose: Verify the conformance of the product with the use of IANALanguageSubtag code values to indicate the natural language of expressions in CharacterStrings. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses values specified in the IANA Language Subtag registry when indicating the natural language of a CharacterString with the property `xml:lang` or an '`@`' language tag, as specified in the NSG vocabulary information model and used in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.6.3, Section 5.5.5)

e) Test type: Basic

A.2.6.4 Test Case for Boolean Datatype

a) Test identifier: Boolean

b) Test purpose: Verify the conformance of the product with the Boolean datatype. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses values in the range of the required datatype `xsd:boolean` for properties specified with the value type Boolean in the NSG vocabulary information model and used in the NCV content baseline specified in the ICS.

d) Reference: NCV Standard (Section 5.3.6.4, Section 5.5.5)

e) Test type: Basic

A.2.6.5 Test Case for CharacterString Datatype

a) Test identifier: CharacterString

b) Test purpose: Verify the conformance of the product with the CharacterString datatype. (**Mandatory**)

c) Test method: (1) Inspect the product to determine that it uses values in the range of the required datatype `rdf:PlainLiteral` for properties specified with the value type CharacterString in the NSG vocabulary information model and used in the NCV content baseline specified in the ICS. (2) Values that are character strings (*e.g.*, values of `xsd:string`) with no language tag satisfy the requirements for the value type CharacterString in the NSG vocabulary information model. (3) Optionally, a language tag may be present.

d) Reference: NCV Standard (Section 5.3.6.5, Section 5.5.5)

e) Test type: Basic

A.2.6.6 Test Case for LocalizedCharacterString Datatype

a) Test identifier: LocalizedCharacterString

b) Test purpose: Verify the conformance of the product with the LocalizedCharacterString datatype. (**Mandatory**)

c) Test method: (1) Inspect the product to determine that it uses values in the range of the required datatype `rdf:PlainLiteral` for properties specified with the value type LocalizedCharacterString in the NSG vocabulary information model and used in the NCV content baseline specified in the ICS. (2) In order to satisfy the requirements for a LocalizedCharacterString in the NSG vocabulary information model, a value shall include both a character string and a language tag.

d) Reference: NCV Standard (Section 5.3.6.6, Section 5.5.5)

e) Test type: Basic

A.2.6.7 Test Case for LocalizedContinuousString Datatype

a) Test identifier: LocalizedContinuousString

b) Test purpose: Verify the conformance of the product with the LocalizedContinuousString datatype. (**Mandatory**)

c) Test method: (1) Inspect the product to determine that it uses values in the range of the required datatype `rdf:PlainLiteral` for properties specified with the value type LocalizedContinuousString in the NSG vocabulary information model and used in the NCV content baseline specified in the ICS. (2) In order to satisfy the requirements for a LocalizedCharacterString in the NSG vocabulary information model, a value shall include both a character string and a language tag. (3) The string portion of the value shall not contain any space characters (unless those are encoded using '%20').

d) Reference: NCV Standard (Section 5.3.6.7, Section 5.5.5)

e) Test type: Basic

A.2.6.8 Test Case for TermCategoryType

a) Test identifier: TermCategoryType

b) Test purpose: Verify the conformance of the product with the values of TermCategoryType as specified in the NSG vocabulary specification. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses values from the enumeration TermCategoryType (encoded by `ncvx:TermCategoryType`) on the required property termCategory (encoded by `ncvx:termCategory`) as specified in the NSG vocabulary information model.

d) Reference: NCV Standard (Section 5.3.6.8, Section 5.5.5, Annex D.2 (Table 24 (rows 5-11)))

e) Test type: Basic

A.2.6.9 Test Case for TermStatusType

a) Test identifier: TermStatusType

b) Test purpose: Verify the conformance of the product with the values of TermStatusType as specified in the NSG vocabulary information model. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses values from the enumeration TermStatusType (encoded by `regx:ItemStatusType`) on the required property termStatus (encoded by `regx:itemStatus`) as specified in the NSG vocabulary information model.

d) Reference: NCV Standard (Section 5.3.6.9, Section 5.5.5, Annex D.3 (Table 25 (rows 1, 2, 4, 5, and 6))

e) Test type: Basic

A.3 *Testing Conformance for a Subset of the NCV Content (Class B)*

For specialized applications or missions, it may be desirable to use only a part of the NCV content. For example, applications in specialized domains may not need to handle vocabulary terms covering topics outside their domains.

It is permissible to use a subset of the NCV content if certain conditions are met. A selective set of vocabulary terms from a specified NCV content baseline is referred to as the "Vocabulary Subset". The conformance conditions that shall be met by the Vocabulary Subset are:

1. Each Vocabulary Subset shall be based on a single officially published content baseline (*i.e.*, registered technical artifact), and all terms in the Vocabulary Subset shall be drawn from that versioned content baseline. (Section 6.2.3)
2. Optionally, the Vocabulary Subset may contain an axiom declaring all terms in the vocabulary to be distinct. If the NCV content baseline specified in the ICS as the basis of the Vocabulary Subset contains an axiom declaring all terms in the vocabulary to be distinct, then either (a) the Vocabulary Subset shall modify that axiom to include only the terms used in the Vocabulary Subset, or (b) the Vocabulary Subset shall optionally omit that axiom. (Class A Test Module: AllDifferentVocabularyTerms, Section A.2.5.3)
3. For each NCV vocabulary term included in the Vocabulary Subset, the vocabulary term shall have the IRI as specified in the registered technical artifacts containing the NCV content baseline specified in the ICS. (Class A Test Case: VocabularyTermIRI, Section A.2.5.1)
4. For each NCV vocabulary term included in the Vocabulary Subset, the term category of the vocabulary term shall be included in the Vocabulary Subset. (Class A Test Case: TermCategory, Section A.2.5.2)
5. For each NCV vocabulary term included in the Vocabulary Subset, all mandatory documentation properties for that vocabulary term shall be included in the Vocabulary Subset, with their values as in the NCV content baseline specified in the ICS. (Class A Test Module: VocabularyTermDocumentation, Section A.2.2)
6. For each NCV AttributeTerm or EntityTerm included in the Vocabulary Subset, if that term has relationship(s) to a CollectorTerm in the NCV content baseline specified in the ICS, then optionally those relationship(s) and the CollectorTerm may be included in the Vocabulary Subset. (Class A Test Module: MembersOfCollectorTerm, Section A.2.5.4)
7. For any two NCV EntityTerms and AttributeTerms terms included in the Vocabulary Subset that are related by hierarchical relationship(s) (broader/narrower) in the NCV content baseline specified in the ICS, then optionally the hierarchical relationship(s) may be included in the Vocabulary Subset. Both terms related by the hierarchical relationship must be included in the Vocabulary Subset. (Class A Test Module: HierarchicalTerms, Section A.2.5.5)
8. For each ListedValueTerm in the specified NCV content baseline that is included in the Vocabulary Subset, the relationship(s) of that ListedValueTerm to its EnumeratedTypeTerm shall also be included in the Vocabulary Subset, along with the EnumeratedTypeTerm. This includes both the memberTermOf relationship and, where applicable, the topTermOf relationship. (Class A Test Module: RelationshipToEnumeratedTypeTerm, Section A.2.5.6.1)
9. For each ListedValueTerm in the specified NCV content baseline that has hierarchical relationships to other EnumeratedTypeTerm included in the Vocabulary Subset that has a hierarchical set of ListedValueTerm members, all broader and narrower term relationships between those members shall be included in the Vocabulary Subset. (Class A Test Module: HierarchicalListedValueTerms, Section A.2.5.6.2)
10. For each ComplexTerm (CollectorTerm or EnumeratedTypeTerm) in the specified NCV content baseline that is included in the Vocabulary Subset, the Vocabulary Subset shall indicate whether the membership of the ComplexTerm is closed (domainComplete = 'TRUE') or open (domainComplete = 'FALSE'), as specified in the NCV content baseline specified in the ICS. (Class A Test Case: Completeness, Section A.2.5.7.1)
11. For each ComplexTerm (CollectorTerm or EnumeratedTypeTerm) in the specified NCV content baseline that is included in the Vocabulary Subset, all members of that ComplexTerm in the specified NCV content baseline shall also be included in the Vocabulary Subset, along with their relationships to the ComplexTerm. This includes both the unidirectional membership relationship (see (6) and (8), above) and, where applicable, the hasTopTerm relationship. (Class A Test Module: ComplexTermMembers, Section A.2.5.7.2)
12. For each NCV ComplexTerm (CollectorTerm or EnumeratedTypeTerm) included in the Vocabulary Subset, the DifferentTerms axiom specified in the NCV content baseline shall also be included in the Vocabulary Subset. (Class A Test Module: DifferentTermsAxioms, Section A.2.5.7.3)

13. A Vocabulary Subset may optionally include only terms from the NCV content baseline specified in the ICS whose termStatus is ‘valid’. (Class A Test Case: VocabularyTermStatus, Section A.2.4.1)
14. Conditional upon including only terms from the specified NCV content baseline whose termStatus is ‘valid’, a Vocabulary Subset shall exclude all predecessorTerm and successorTerm relationships from the Vocabulary Subset. (Waiver of Class A Test Case: PredecessorTerm and Class A Test Case: SuccessorTerm, Section A.2.4.4 and Section A.2.4.5)

A.4 *Testing Conformance for Use of the NCV Content with Extensions (Class C)*

A specific system or application may have requirements that make it desirable to specify additional vocabulary terms that are not included in the NCV content. For example, there may be a business need to describe data using terms that are not defined in the NCV content.

It is permissible to use the NCV content with local extensions if certain conditions are met. The set of extensions to the NCV content is referred to here as the “Vocabulary Extension”. In the requirements statements, the phrase “included in” means “belongs to the namespace of”. The conditions that shall be met by the Vocabulary Extension are:

1. Each Vocabulary Extension shall import either a single NCV content baseline or a valid Vocabulary Subset based on a single NCV content baseline. (Section 6.2.3 or Section A.3)
2. The implementation shall pass the ATS for the NCV Standard either using the NCV content as a whole (Class A), or under the conditions for a valid Vocabulary Subset (Class B), with respect to the NCV content baseline specified in the ICS. (Section A.2 or Section A.3)
3. The Vocabulary Extension shall be assigned a URI base different from that of the NCV.
4. New (non-NCV) vocabulary terms and/or properties belonging to the Vocabulary Extension shall be assigned IRIs in the namespace of the Vocabulary Extension.
5. Except for the use of the different URI base, the Vocabulary Extension shall conform to the NSG vocabulary specification, which includes the NSG vocabulary information model that is specified in the NCV Standard, Section 5.3, and its specified implementation in SKOS (Section 5.5). New vocabulary terms and/or properties belonging to the Vocabulary Extension shall be consistent with the NSG vocabulary specification. (Section A.5, Abstract Test Suite: Class D)
6. The Vocabulary Extension shall not contain any term that is equivalent in meaning to a vocabulary term defined in the NCV content baseline specified in the ICS.
7. The Vocabulary Extension may contain new aliases (using `skos:altLabel`) for NCV vocabulary terms.
8. The Vocabulary Extension may contain hierarchical relationships between (non-NCV) vocabulary terms in the Vocabulary Extension and NCV vocabulary terms in the NCV content baseline specified in the ICS, consistent with the meaning of the NCV vocabulary terms. (Section A.2.5.5, Test Module: HierarchicalTerms)

   NOTE: New hierarchical relationships shall not be added between two NCV vocabulary terms.
9. For an open NCV ComplexTerm (*i.e.*, a CollectorTerm or EnumeratedTypeTerm with domainComplete = ‘FALSE’), it is permissible to declare new members that are BasicVocabularyTerms in the Vocabulary Extension namespace. In that case, a DifferentTerms axiom including all the members of the ComplexTerm shall be declared in the Vocabulary Extension, including all new members defined in the Vocabulary Extension as well as all members defined in the NCV content baseline specified in the ICS.
10. Requirements for new TermCategoryTypes shall be submitted to the GEOINT Content Standards Board, in accordance with the Governance process specified in Section 6.
11. As a recommended best practice, approved Vocabulary Extensions conformant with the NSG vocabulary information model should be published in the NSG Standards Registry for reference and re-use, and to support future potential integration with the NCV Standard.

The content of a Vocabulary Extension may be proposed for inclusion in a future version of the NCV content (and therefore the NCV namespace) using the procedures described in Section 6 about the Governance Process.

A.5 *Abstract Test Suite for Conformance to the NSG Vocabulary Specification (Class D)*

a) Test identifier: ATS_NSGD

b) Test purpose: Verify the conformance of the product with the NSG vocabulary specification in the NCV Standard. (**Mandatory**)

NOTE1: This test is required for products that claim conformance to the NSG vocabulary specification for a vocabulary that defines non-NCV content.

NOTE2: The implementation conformance statement (ICS) for the product being tested shall specify the general capabilities of the vocabulary.

c) Test method: Inspect the product to determine that it contains the required vocabulary dependencies (A.5.1), vocabulary documentation (A.5.2), vocabulary term documentation (A.5.3), vocabulary term-management information (A.5.4), vocabulary term structural elements (A.5.5), and required datatypes (A.5.6), in accordance with the requirements of the NSG vocabulary specification.

d) Reference: NCV Standard (Section 5)

e) Test type: Basic

NOTE3: In this ATS, the elements and assertions of the vocabulary are referred to collectively as the “vocabulary content”.

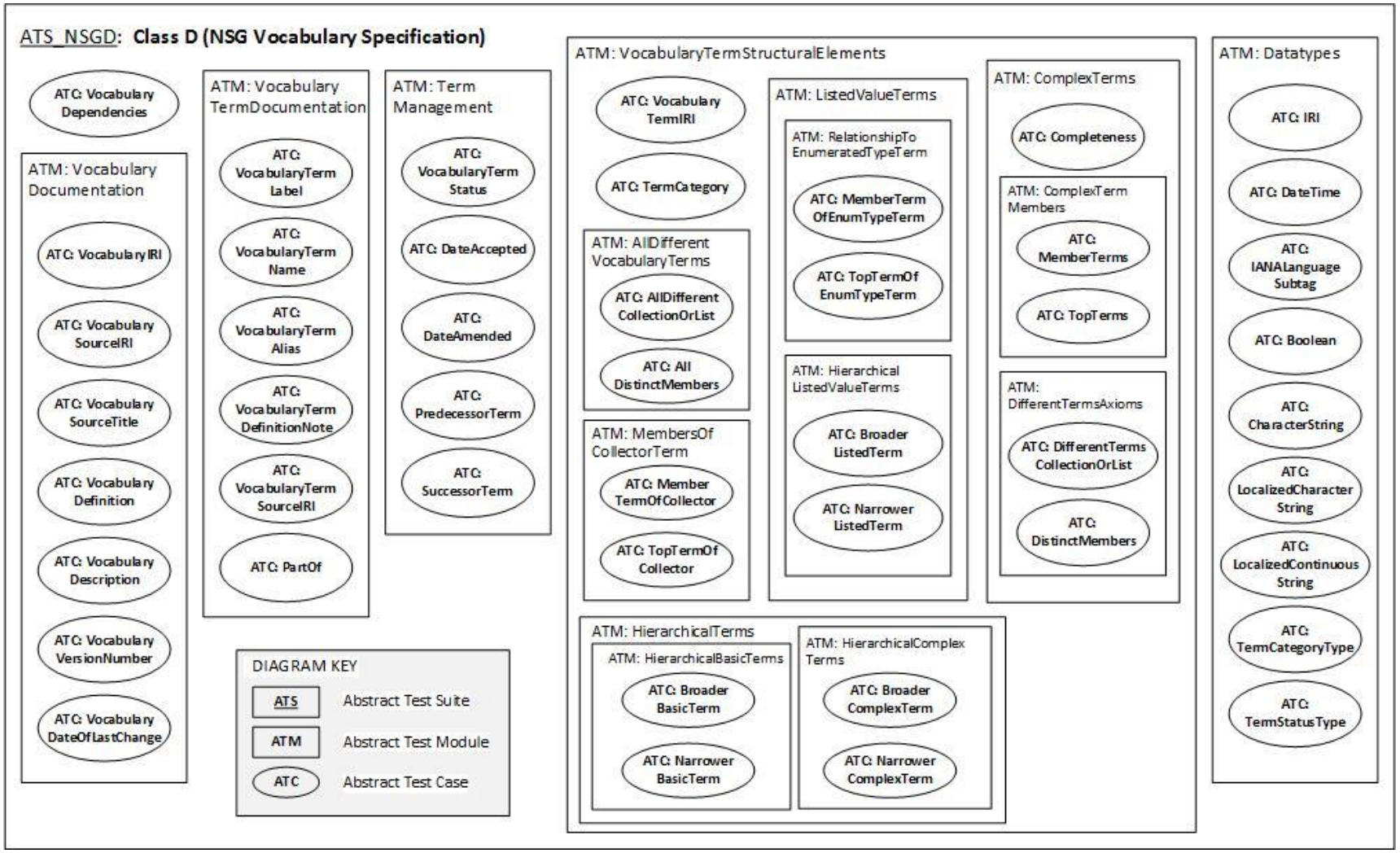


Figure 12 – Structure of the Abstract Test Suite (Class D) for Conformance to the NSG Vocabulary Specification

A.5.1 Test Case for Vocabulary Dependencies

a) Test identifier: VocabularyDependencies

b) Test purpose: Verify the conformance of the product with all dependencies in the vocabulary content. (**Mandatory**)

c) Test method: Inspect the product to determine that it correctly identifies all elements from external namespaces or schemas used in the vocabulary content encoding(s).

1) (RDF/XML encoding) The vocabulary content shall contain namespace declarations and namespace abbreviations (for example: ‘skos’, ‘dct’, ‘xml’, ‘ncvx’) for all elements from external namespaces, including for required elements of the vocabulary information model.

2) (N-Triples encoding) The vocabulary content shall correctly reference the full URIs for all elements from external namespaces, including for required elements of the vocabulary information model.

d) Reference: NCV Standard (Section 5.5; Annex D)

e) Test type: Basic

A.5.2 Test Module for Vocabulary Documentation

a) Test identifier: VocabularyDocumentation

b) Test purpose: Verify the conformance of the product with the documentation required by the NSG vocabulary specification. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required vocabulary documentation information with the correct values for the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.4.4; Section 5.5.3)

e) Test type: Basic

A.5.2.1 Test Case for Vocabulary Identifier

a) Test identifier: VocabularyIRI

b) Test purpose: Verify the conformance of the product with the documentation of the identifier for the vocabulary content. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required namespace documentation with the IRI for the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.4.4 (item 1); Section 5.5.3 (Figure 4 (as template) and Table 16 (row 2)))

e) Test type: Basic

A.5.2.2 Test Case for Vocabulary Source IRI

a) Test identifier: VocabularySourceIRI

b) Test purpose: Verify the conformance of the product with documentation of the IRI for the NCV Standard document in which the NSG vocabulary specification applicable to the vocabulary content is specified. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required documentation of the IRI for the edition of the NCV Standard document identified in the ICS.

d) Reference: NCV Standard (Section 5.4.4 (item 2); Section 5.5.3 (Figure 4 and Table 16 (row 7)))

e) Test type: Basic

A.5.2.3 Test Case for Vocabulary Source Title

a) Test identifier: VocabularySourceTitle

b) Test purpose: Verify the conformance of the product with the documentation of the title of the NCV Standard document in which the NSG vocabulary specification applicable to the vocabulary content is published. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the required documentation of the title of the NCV Standard document identified in the ICS.

d) Reference: NCV Standard (Section 5.4.4 (item 2); Section 5.5.3 (Figure 4 and Table 16 (row 8)))

e) Test type: Basic

A.5.2.4 Test Case for Vocabulary Definition

a) Test identifier: VocabularyDefinition

b) Test purpose: Verify the conformance of the product with documentation of the definition for the vocabulary. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains documentation of the human-readable definition of the vocabulary, which describes its domain content and scope.

d) Reference: NCV Standard (Section 5.4.4 (item 3); Section 5.5.3 (Figure 4 and Table 16 (row 10)))

e) Test type: Basic

A.5.2.5 Test Case for Vocabulary Description

a) Test identifier: VocabularyDescription

b) Test purpose: Verify the conformance of the product with documentation of the description for the vocabulary. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains documentation of the human-readable description for the vocabulary including, if applicable, special usage notes and identification of the external authority for the domain content.

d) Reference: NCV Standard (Section 5.4.4 (item 4); Section 5.5.3 (Figure 4 and Table 16 (row 10)))

e) Test type: Basic

A.5.2.6 Test Case for Vocabulary Version Number

a) Test identifier: VocabularyVersionNumber

b) Test purpose: Verify that the product has documented the version number of the vocabulary content specified in the ICS. (Conditional)

c) Test method: Inspect the product to determine that it contains the version number (if applicable) of the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.4.4 (item 5); Section 5.5.3 (Figure 4 and Table 16 (row 3)))

e) Test type: Basic

A.5.2.7 Test Case for Vocabulary Date of Last Change

a) Test identifier: VocabularyDateOfLastChange

b) Test purpose: Verify that the product has documented the date of last change for that vocabulary content. (Conditional)

c) Test method: Inspect the product to determine that it indicates the date of last change (if applicable) for the vocabulary content.

d) Reference: NCV Standard (Section 5.4.4 (item 6); Section 5.5.3 (Figure 5 (as template) and Table 16 (row 9)))

e) Test type: Basic

A.5.3 Test Module for VocabularyTerm Documentation

a) Test identifier: VocabularyTermDocumentation

b) Test purpose: Verify the conformance of the product with the required documentation properties for each VocabularyTerm as specified in the NSG vocabulary specification. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains values for all required documentation properties for each VocabularyTerm in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3, Section 5.5.4.2, Section 5.5.4.3)

e) Test type: Basic

A.5.3.1 Test Case for Conformance to VocabularyTerm Label

a) Test identifier: VocabularyTermLabel

b) Test purpose: Verify the conformance of the product with the documentation of the label for each VocabularyTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each VocabularyTerm has the required documentation property (`rdfs:label`) with the value as specified in the vocabulary content specified in the ICS. The value is the same as the terminal component of the VocabularyTerm IRI.

d) Reference: NCV Standard (Section 5.5.4.2 (Table 17 (row 3)), Section 5.5.4.3 (Table 18 (row 3)))

e) Test type: Basic

A.5.3.2 Test Case for VocabularyTerm Name

a) Test identifier: VocabularyTermName

b) Test purpose: Verify the conformance of the product with documentation of the name for each VocabularyTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each VocabularyTerm has the required documentation property (`skos:prefLabel`) with the value for the preferred human-readable name of the vocabulary term as specified in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.5.4.2 (Table 17 (row 4)), Section 5.5.4.3 (Table 18 (row 4)))

e) Test type: Basic

NOTE: The preferred human-readable name of the VocabularyTerm shall be used to refer to that class in navigation menus, browse trees, and other displays.

A.5.3.3 Test Case for VocabularyTerm Alias

a) Test identifier: VocabularyTermAlias

b) Test purpose: Verify the conformance of the product with documentation of the optional alias(es), if any, for each VocabularyTerm. (Conditional)

c) Test method: Inspect the product to determine that each VocabularyTerm has the documentation property (`skos:altLabel`) with the value(s) specified (if any) in the vocabulary content specified in the ICS.

NOTE: *Alias* is an optional element of the NSG vocabulary specification.

d) Reference: NCV Standard (Section 5.5.4.2 (Table 17 (row 5)), Section 5.5.4.3 (Table 18 (row 5)))

e) Test type: Basic

A.5.3.4 Test Case for VocabularyTerm Definition Note

a) Test identifier: VocabularyTermDefinitionNote

b) Test purpose: Verify the conformance of the product with documentation of the required definitionNote for each VocabularyTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each VocabularyTerm has the required documentation property (`skos:definition`) with the value as specified in the vocabulary content as specified in the ICS.

d) Reference: NCV Standard (Section 5.5.4.2 (Table 17 (row 6)), Section 5.5.4.3 (Table 18 (row 6)))

e) Test type: Basic

A.5.3.5 Test Case for Vocabulary Term Source IRI

a) Test identifier: VocabularyTermSourceIRI

b) Test purpose: Verify the conformance of the product with documentation of the required sourceIRI for each VocabularyTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each VocabularyTerm has the required documentation property (`rdfs:isDefinedBy`) with the value specified in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.5.4.2 (Table 17 (row 7)), Section 5.5.4.3 (Table 18 (row 7)))

e) Test type: Basic

A.5.3.6 Test Case for Part-of

a) Test identifier: PartOf

b) Test purpose: Verify the conformance of the product with the required use of `dct:isPartOf` declarations. (Conditional on a product that represents an encoding for each individual VocabularyTerm in a separate resource file)

c) Test method: Inspect the product to determine that in each individual resource file, the VocabularyTerm has the documentation property `dct:isPartOf` with the value of the IRI for the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 6.2.4)

e) Test type: Basic

A.5.4 Test Module for Term Management

a) Test identifier: TermManagement

b) Test purpose: Verify the conformance of the product with the metadata attribution required for management of the controlled VocabularyTerms. (**Mandatory**)

c) Test method: Inspect the product to determine that VocabularyTerms have the required annotation properties and term relationships for documenting vocabulary management, as specified in the NSG vocabulary information model, with values encoded in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Basic

A.5.4.1 Test Case for VocabularyTerm Status

a) Test identifier: VocabularyTermStatus

b) Test purpose: Verify the conformance of the product with the requirement that each VocabularyTerm shall have a declaration of its status. (**Mandatory**)

c) Test method: Inspect the product to determine whether each VocabularyTerm has the required termStatus property indicating whether it is ‘valid’, ‘superseded’, or ‘retired’, with the value specified in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 9)), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Basic

A.5.4.2 Test Case for Date Accepted

a) Test identifier: DateAccepted

b) Test purpose: Verify the conformance of the product with the requirement that each VocabularyTerm shall have a declaration of the date on which it was accepted into the vocabulary content. (**Mandatory**)

c) Test method: Inspect the product to determine whether each VocabularyTerm has the required dateAccepted property, with the date value in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 10)), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Basic

A.5.4.3 Test Case for Date Amended

a) Test identifier: DateAmended

b) Test purpose: Verify the conformance of the product with the conditional requirement that if a VocabularyTerm has been retired or superseded, then that VocabularyTerm shall have a declaration of the date on which it was thus amended. (Conditional)

c) Test method: Inspect the product to determine whether each VocabularyTerm having a termStatus of ‘retired’ or ‘superseded’ has a dateAmended property, with the date value specified in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 11)), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Basic

A.5.4.4 Test Case for Predecessor Term

a) Test identifier: PredecessorTerm

b) Test purpose: Verify the conformance of the product with the requirement that, for each term that has superseded another VocabularyTerm in the vocabulary, a unique predecessor relation to the VocabularyTerm that it replaced shall also be declared. (Conditional)

c) Test method: Inspect the product to determine whether, for each VocabularyTerm that is the successor (object) in a successorTerm relationship, that VocabularyTerm is also declared to have (as subject) the inverse predecessorTerm relationship to the VocabularyTerm that it replaced, as specified in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 12)), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Capability test

A.5.4.5 Test Case for Successor Term

a) Test identifier: SuccessorTerm

b) Test purpose: Verify the conformance of the product with the option that a successorTerm relation to another VocabularyTerm that replaced it may be declared for any superseded VocabularyTerm in the vocabulary. (Optional)

c) Test method: Inspect the product to determine whether, for every VocabularyTerm that has a successorTerm relationship to another VocabularyTerm, the term having the successor has the required termStatus value of ‘superseded’ in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 13)), Section 5.5.4.2, and Section 5.5.4.3)

e) Test type: Capability test

A.5.5 Test Module for VocabularyTerm Structural Elements

a) Test identifier: VocabularyTermStructuralElements

b) Test purpose: Verify the conformance of the product with the required NSG vocabulary structural elements. (**Mandatory**)

c) Test method: Inspect the product to determine that it contains the applicable structural elements, including vocabulary term identifiers (A.5.5.1), vocabulary term categories (A.5.5.2), (optional) axiom declaring all vocabulary terms distinct (A.5.5.3), member relationships to collectors (A.5.5.4), hierarchical term relationships (A.5.5.5), listed value terms (A.5.5.6), and complex vocabulary terms (A.5.5.7), for the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3, Section 5.5.2, and Section 5.5.4)

e) Test type: Basic

A.5.5.1 Test Case for VocabularyTerm Identifiers

a) Test identifier: VocabularyTermIRI

b) Test purpose: Verify the conformance of the product with the pattern for vocabulary term identifiers (IRIs) specified in the NSG vocabulary specification. (**Mandatory**)

c) Test method: Inspect the product to determine that each of the vocabulary terms defined in the product has a unique IRI identifier conformant to the pattern specified in the NSG vocabulary specification and using the namespace (URI Base plus separator) specified in the ICS.

d) Reference: NCV Standard (Section 5.5.2)

e) Test type: Basic

A.5.5.2 Test Case for VocabularyTerm Category

a) Test identifier: TermCategory

b) Test purpose: Verify the conformance of the product with the requirement that every vocabulary term shall be an instance of a concrete subclass of *VocabularyTerm* as indicated by its term category. (**Mandatory**)

c) Test method: Inspect the product to determine that every vocabulary term has the property *termCategory* (`ncvx:termCategory`) with one of the following values: [for terms encoded with `ncvx:BasicVocabularyTerm` or `skos:Concept`] 'entity', 'attribute', or 'listedValue'; or [for terms encoded using `ncvx:ComplexVocabularyTerm` or `skos:ConceptScheme`] 'collector' or 'enumeratedType', for all vocabulary terms in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 4 (row 8)), Section 5.3.4 (Tables 7-11, Constraints), Section 5.3.6.8))

e) Test type: Capability test

A.5.5.3 Test Module for Distinct VocabularyTerms

a) Test identifier: AllDifferentVocabularyTerms

b) Test purpose: Verify the conformance of the product with an optional assertion of an axiom declaring that all the VocabularyTerms in the vocabulary are pairwise distinct. (Conditional)

NOTE: The meanings of vocabulary terms that are members of a DifferentTermsAxiom may overlap (as in the case of ListedValueTerms that are hierarchical terms belonging to the same EnumeratedTypeTerm); however, member terms of a DifferentTermsAxiom shall not be identical in meaning with each other.

c) Test method: Inspect the product to determine that if the vocabulary content specified in the ICS contains a DifferentTermsAxiom applicable to all vocabulary terms in the vocabulary, then that axiom is properly represented in the applicable encoding format.

d) Reference: NCV Standard (Section 5.3.5, Section 5.5.4.4 (Table 19))

e) Test type: Basic test

A.5.5.3.1 Test Module for DifferentTerms Collection or List

a) Test identifier: AllDifferentCollectionOrList

b) Test purpose: Verify the conformance of the product with an optional declaration that all VocabularyTerms in the vocabulary are pairwise distinct. (Conditional)

c) Test method: Inspect the product to determine whether it contains exactly one DifferentTerms class axiom (using `owl:AllDifferent`) whose declared members are all the VocabularyTerms in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.5 (Table 12 (row 1)), Section 5.5.4.4 (Table 19 (row 1)))

e) Test type: Capability test

A.5.5.3.2 Test Module for DistinctMembers

a) Test identifier: AllDistinctMembers

b) Test purpose: Verify the conformance of the product with an optional declaration that all VocabularyTerms in the vocabulary are pairwise distinct in meaning. (Conditional)

c) Test method: Inspect the product to determine that each VocabularyTerm in the vocabulary content specified in the ICS is included as a member in the DifferentTerms class axiom declaring all terms in the vocabulary content to be pairwise distinct.

d) Reference: NCV Standard (Section 5.3.5 (Table 12 (row 2)), Section 5.5.4.4 (Table 19 (row 2)))

e) Test type: Capability test

A.5.5.4 Test Module for Members of CollectorTerm

a) Test identifier: MembersOfCollectorTerm

b) Test purpose: Verify the conformance of the product with the requirement that each EntityTerm or AttributeTerm that belongs to a CollectorTerm shall have a member-term-of and (if applicable) a top-term-of relationship to that CollectorTerm. (**Mandatory**)

c) Test method: Inspect the product to determine whether each EntityTerm and AttributeTerm in the vocabulary content specified in the ICS that belongs to a CollectorTerm(s) has the required membership relationships (A.5.5.5.1 and A.5.5.5.2).

d) Reference: NCV Standard (Section 5.3.4 (Constraints in Tables 7-8), Section 5.5.4.2 (Table 17))

e) Test type: Capability test

A.5.5.4.1 Test Case for Member Term of CollectorTerm

a) Test identifier: MemberTermOfCollector

b) Test purpose: Verify the conformance of the product with the requirement that each EntityTerm or AttributeTerm that belongs to a CollectorTerm shall have a member-term-of relationship to that CollectorTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each EntityTerm or AttributeTerm that belongs to a CollectorTerm has the required member-term-of relationship (using `skos:inScheme`) in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 4)), Section 5.5.4.2 (Table 17 (row 16)), Section 5.3.4 (Constraints in Tables 7-8))

e) Test type: Capability test

A.5.5.4.2 Test Case for Top Term of CollectorTerm

a) Test identifier: TopTermOfCollector

b) Test purpose: Verify the conformance of the product with the requirement that if an EntityTerm or AttributeTerm is a member of a CollectorTerm and has no broader term that is a member of the same CollectorTerm, then that EntityTerm or AttributeTerm shall have a top-term-of relationship to that CollectorTerm. (Conditional)

c) Test method: Inspect the product to determine that each EntityTerm or AttributeTerm which is a member of a CollectorTerm and has no broader term that is a member of the same CollectorTerm is asserted to have a top-term-of relationship to that CollectorTerm in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 5)), Section 5.5.4.2 (Table 17 (row 17)), Section 5.3.4 (Constraints in Tables 7-8))

e) Test type: Capability test

A.5.5.5 Test Module for Hierarchical Term Relationships

a) Test identifier: HierarchicalTerms

b) Test purpose: Verify the conformance of the product with the requirement that every vocabulary term which has a hierarchical (broader or narrower) relationship(s) with another vocabulary term shall be related by the appropriate relationship only to a vocabulary term(s) of the same term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether every vocabulary term which has a hierarchical relationship to another vocabulary term is related by the appropriate relationship only to a term(s) that has the same value of term category, as specified in the vocabulary content specified in the ICS.

NOTE: This test module is applied only to EntityTerms and AttributeTerms. All ListedValueTerms having hierarchical relationships are evaluated in the Test Module for ListedValueTerms (Section A.5.5.6).

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (rows 2-3 and Constraints 1-2)), Section 5.5.4.2 (Table 17 (row 8; rows 14-15)), Section 5.3.3 (Table 6 (rows 4-5 and Constraints 3-4)), Section 5.5.4.3 (Table 18 (row 8; rows 15-16), Section 5.3.6.8)

e) Test type: Capability test

A.5.5.5.1 Test Module for Hierarchical Basic Terms

a) Test identifier: HierarchicalBasicTerms

b) Test purpose: Verify the conformance of the product with the requirement that every basic vocabulary term which has a hierarchical (broader or narrower) relationship(s) with another term shall be related only to a basic vocabulary term(s) of the same term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each basic vocabulary term which has a hierarchical (broader or narrower) relationship is related only to another basic vocabulary term(s) having the same value of term category, as specified in the vocabulary content specified in the ICS.

NOTE: This test module is applied only to EntityTerms and AttributeTerms. All ListedValueTerms having hierarchical relationships are evaluated in the Test Module for ListedValueTerms (Section A.5.5.6).

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (rows 2-3 and Constraints 1-2)), Section 5.5.4.2 (Table 17 (row 8; rows 14-15)), Section 5.3.6.8)

e) Test type: Capability test

A.5.5.5.1.1 Test Case for Broader Basic Term

a) Test identifier: BroaderBasicTerm

b) Test purpose: Verify the conformance of the product with the requirement that every basic vocabulary term which has a broader-term relationship to another vocabulary term shall be related only to a basic vocabulary term having the same value of term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each basic vocabulary term which has a broader-term relationship to another vocabulary term has the same value of term category as the broader term, as specified in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 2 and Constraint 1)), Section 5.5.4.2 (Table 17 (rows 8 and 14)), Section 5.3.6.8)

e) Test type: Capability test

A.5.5.5.1.2 Test Case for Narrower Basic Term

a) Test identifier: NarrowerBasicTerm

b) Test purpose: Verify the conformance of the product with the requirement that every basic vocabulary term which has a narrower-term relationship to another vocabulary term shall be related only to a basic vocabulary term having the same value of term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each basic vocabulary term which has a narrower-term relationship to another vocabulary term has the same value of term category as the broader term, as specified in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 3 and Constraint 2)), Section 5.5.4.2 (Table 17 (rows 8 and 15)), Section 5.3.6.8)

e) Test type: Capability test

A.5.5.5.2 Test Module for Hierarchical Complex Terms

a) Test identifier: HierarchicalComplexTerms

b) Test purpose: Verify the conformance of the product with the requirement that every complex vocabulary term which has a hierarchical (broader or narrower) relationship(s) with another term shall be related only to a complex vocabulary term(s) of the same term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each complex vocabulary term which has a hierarchical (broader or narrower) relationship is related only to another complex vocabulary term(s) having the same value of term category, as specified in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (rows 4-5 and Constraints 3-4)), Section 5.5.4.2 (Table 18 (row 8; rows 16-17)), Section 5.3.6.8)

e) Test type: Capability test

A.5.5.5.2.1 Test Case for Broader Complex Term

a) Test identifier: BroaderComplexTerm

b) Test purpose: Verify the conformance of the product with the requirement that every complex vocabulary term which has a broader-term relationship to another vocabulary term shall be related only to a complex vocabulary term having the same value of term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each complex vocabulary term which has a broader-term relationship to another vocabulary term has the same value of term category as the broader term, as specified in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (row 4 and Constraint 3)), Section 5.5.4.2 (Table 18 (rows 8 and 16)), Section 5.3.6.8)

e) Test type: Capability test

A.5.5.5.2.2 Test Case for Narrower Complex Term

a) Test identifier: NarrowerComplexTerm

b) Test purpose: Verify the conformance of the product with the requirement that every complex vocabulary term which has a narrower-term relationship to another vocabulary term shall be related only to a complex vocabulary term having the same value of term category. (**Mandatory**)

c) Test method: Inspect the product to determine whether each complex vocabulary term which has a narrower-term relationship to another vocabulary term has the same value of term category as the narrower term, as specified in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (row 4 and Constraint 4)), Section 5.5.4.2 (Table 18 (rows 8 and 17)), Section 5.3.6.8)

e) Test type: Capability test

A.5.5.6 Test Module for ListedValueTerms

a) Test identifier: ListedValueTerms

b) Test purpose: Verify the conformance of the product with the required structural elements for ListedValueTerms. (**Mandatory**)

c) Test method: Inspect the product to determine that each ListedValueTerm has the required membership relationship(s) to exactly one EnumeratedTypeTerm (A.5.5.6.1), and, if applicable, that it has any hierarchical relationships to other ListedValueTerms (A.5.5.6.2), in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5), Section 5.3.4 (Constraints in Table 9), Section 5.5.4.2 (Table 17))

e) Test type: Capability test

A.5.5.6.1 Test Module for Relationships to EnumeratedTypeTerm

a) Test identifier: RelationshipToEnumeratedTypeTerm

b) Test purpose: Verify the conformance of the product with the requirement that each ListedValueTerm shall belong to exactly one EnumeratedTypeTerm and, if applicable, shall be a top term of the same EnumeratedTypeTerm. (**Mandatory**)

c) Test method: Inspect the product to determine whether each ListedValueTerm has a membership relationship to exactly one EnumeratedTypeTerm, and, if applicable, has a top term relationship to the same EnumeratedTypeTerm (A.5.5.6.1.1 and A.5.5.6.1.2), in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5), Section 5.3.4 (Constraints in Table 9), Section 5.5.4.2 (Table 17))

e) Test type: Capability test

A.5.5.6.1.1 Test Case for Member Term of EnumeratedTypeTerm

a) Test identifier: MemberTermOfEnumTypeTerm

b) Test purpose: Verify the conformance of the product with the requirement that each ListedValueTerm shall belong to exactly one EnumeratedTypeTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each ListedValueTerm has a member-term-of relationship (using `skos:inScheme`) to exactly one EnumeratedTypeTerm, in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 4)), Section 5.3.4 (Constraints 2-3 in Table 9), Section 5.5.4.2 (Table 17 (row 16)))

e) Test type: Capability test

A.5.5.6.1.2 Test Case for Top Term of EnumeratedTypeTerm

a) Test identifier: TopTermOfEnumTypeTerm

b) Test purpose: Verify the conformance of the product with the requirement that if a ListedValueTerm is a member of an EnumeratedTypeTerm and has no broader term that is a member of the same EnumeratedTypeTerm, then that ListedValueTerm shall have a top-term-of relationship to that EnumeratedTypeTerm. (Conditional)

c) Test method: Inspect the product to determine that each ListedValueTerm which is a member of an EnumeratedTypeTerm and has no broader term that is a member of the same EnumeratedTypeTerm, is asserted to have a top-term-of relationship to that EnumeratedTypeTerm, in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 5)), Section 5.3.4 (Constraint 4 in Table 9), Section 5.5.4.2 (Table 17 (row 17)))

e) Test type: Capability test

A.5.5.6.2 Test Module for Hierarchical Relationships Between ListedValueTerms

a) Test identifier: HierarchicalListedValueTerms

b) Test purpose: Verify the conformance of the product with the requirement that a ListedValueTerm that is a member of an EnumeratedTypeTerm representing a hierarchical set of listed values shall have broader-term and narrower-term relationships (if applicable) with one or more other ListedValueTerms that are members of the same EnumeratedTypeTerm. (Conditional)

c) Test method: Inspect the product to determine whether the ListedValueTerm is a member of an EnumeratedTypeTerm that represents a hierarchical set of listed values; if so, then determine whether the ListedValueTerm has a broader-term relationship (A.5.5.6.2.1) and/or narrower-term relationship(s) (A.5.5.6.2.2) to other ListedValueTerm(s) in the same EnumeratedTypeTerm.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (rows 2-3)), Section 5.5.4.2 (Table 17 (rows 14-15)))

e) Test type: Capability test

A.5.5.6.2.1 Test Case for Broader Term

a) Test identifier: BroaderListedTerm

b) Test purpose: Verify the conformance of the product with the requirement that a broader-term relationship be declared for each ListedValueTerm that is a narrower term of another ListedValueTerm. (Conditional)

c) Test method: Inspect the product to determine whether the ListedValueTerm being tested is a member of an EnumeratedTypeTerm that represents a hierarchical domain of values; if so, then that ListedValueTerm should have a broader-term relationship to another ListedValueTerm that is a member of that EnumeratedTypeTerm, unless the ListedValueTerm being tested is a “top term” of the EnumeratedTypeTerm, in which case it has only narrower-term relationships (see A.5.5.6.2.2)

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 2 and Constraint 1)), Section 5.5.4.2 (Table 17 (row 14))5.3.6.8)

e) Test type: Capability test

A.5.5.6.2.2 Test Case for Narrower Term

a) Test identifier: NarrowerListedTerm

b) Test purpose: Verify the conformance of the product with the requirement that a narrower-term relationship be declared for each ListedValueTerm that is a broader term of another ListedValueTerm. (Conditional)

c) Test method: Inspect the product to determine whether the ListedValueTerm being tested is a broader term for another ListedValueTerm; if so, then the ListedValueTerm being tested should be declared to have a narrower-term (*i.e.*, inverse) relationship to that other ListedValueTerm.

d) Reference: NCV Standard (Section 5.3.3 (Table 5 (row 3 and Constraint 2)), Section 5.5.4.2 (Table 17 (row 15)5.3.6.8))

e) Test type: Capability test

A.5.5.7 Test Module for ComplexVocabularyTerms

a) Test identifier: ComplexTerms

b) Test purpose: Verify the conformance of the product with the required structural properties for vocabulary terms having the term category of CollectorTerm or EnumeratedTypeTerm. (**Mandatory**)

c) Test method: Inspect the product to determine that each CollectorTerm and EnumeratedTypeTerm has the required structural elements.

d) Reference: NCV Standard (Section 5.3.3 (Table 6), Section 5.3.5 (Table 12), Section 5.5.4.3 (Table 18), Section 5.5.4.4 (Table 19))

e) Test type: Capability test

A.5.5.7.1 Test Case for ComplexVocabularyTerm Completeness

a) Test identifier: Completeness

b) Test purpose: Verify the conformance of the product with the requirement that each ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) be declared as representing either a

complete (*i.e.*, closed and non-extensible) or incomplete (*i.e.*, open and extensible) domain of VocabularyTerms. (**Mandatory**)

c) Test method: Inspect the product to determine that, in the vocabulary content specified in the ICS: (1) each CollectorTerm (collection of EntityTerms and/or AttributeTerms) has the Boolean attribute domainComplete (`ncvx:domainComplete`) declared with either the value 'TRUE' (if the collection is complete) or the value 'FALSE' (if the collection is open); and (2) each EnumeratedTypeTerm (collection of ListedValueTerms) has the Boolean attribute domainComplete (`ncvx:domainComplete`) declared with either the value 'TRUE' (if the collection is complete) or the value 'FALSE' (if the collection is open).

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (row 2)), Section 5.5.4.3 (Table 18 (row 14)))

e) Test type: Basic test

A.5.5.7.2 Test Module for ComplexVocabularyTerm Members

a) Test identifier: ComplexTermMembers

b) Test purpose: Verify the conformance of the product with the requirement that every ComplexVocabularyTerm be declared to have one or more BasicVocabularyTerms of the appropriate type(s) as members, with a subset of those as top terms. (**Mandatory**)

c) Test method: Inspect the product to determine whether each ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) in the vocabulary specified in the ICS has one or more BasicVocabularyTerms of the appropriate type(s) declared as members, and a subset of those declared as top terms. (1) Each member of a CollectorTerm shall be either an EntityTerm or an AttributeTerm. (2) Each member of an EnumeratedTypeTerm shall be a ListedValueTerm.

NOTE: The set of top terms is not required to be a proper subset of the member terms. In the case of a ComplexVocabularyTerm for which no member vocabulary term has a broader term that is also a member of the ComplexVocabularyTerm, all member vocabulary terms are declared to be top terms.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (row 3 and Constraint 1)), Section 5.3 (Table 10 (Constraint 2), Table 11 (Constraint 2)), Section 5.5.4.3 (Table 18 (row 15)), Section A.5.5.4.1, Section A.5.5.6.1.1)

e) Test type: Capability test

A.5.5.7.2.1 Test Case for Member Terms

a) Test identifier: MemberTerms

b) Test purpose: Verify the conformance of the product with the requirement that every ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) be declared to have one or more BasicVocabularyTerms (AttributeTerm, EntityTerm, or ListedValueTerm) of the appropriate type(s) as members. (**Mandatory**)

c) Test method: Inspect the product to determine whether (1) each CollectorTerm has one or more EntityTerms and/or AttributeTerms declared as its members; and (2) each EnumeratedTypeTerm has one or more ListedValueTerms declared as its members, using `skos:inScheme`, in the vocabulary content specified in the ICS.

NOTE: The membership relationship between a ComplexVocabularyTerm and a BasicVocabularyTerm is a unidirectional association represented from the member term to the complex term. (See Section A.5.5.4.1 and Section A.5.5.6.1.1)

d) Reference: NCV Standard (Section A.5.5.4.1, Section A.5.5.6.1.1)

e) Test type: Capability test

A.5.5.7.2.2 Test Case for Top Terms

a) Test identifier: TopTerms

b) Test purpose: Verify the conformance of the product with the requirement that every ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) be declared to have one or more BasicVocabularyTerms (AttributeTerm, EntityTerm, or ListedValueTerm) of the appropriate type(s) as top terms. (**Mandatory**)

c) Test method: Inspect the product to determine whether (1) each CollectorTerm has one or more EntityTerms and/or AttributeTerms declared to be a top term of the CollectorTerm, and (2) each EnumeratedTypeTerm has one or more ListedValueTerms declared to be a top term of the EnumeratedTypeTerm, using `skos:hasTopConcept`, in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.3 (Table 6 (row 3)), Section 5.5.4.3 (Table 18 (row 15)))

e) Test type: Capability test

A.5.5.7.3 Test Module for DifferentTerms Axioms

a) Test identifier: DifferentTermsAxioms

b) Test purpose: Verify the conformance of the product with the requirement that for every ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm), there shall be an axiom declaring that all member BasicVocabularyTerms of that ComplexVocabularyTerm are distinct from each other. (**Mandatory**)

NOTE: The meanings of BasicVocabularyTerms that are members of a ComplexVocabularyTerm may overlap (as in the case of ListedValueTerms that are hierarchical terms belonging to the same EnumeratedTypeTerm); however, member terms of a ComplexVocabularyTerms shall not be identical in meaning with each other.

c) Test method: Inspect the product to determine that the set of members of each ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) has a DifferentTerms axiom properly represented in the applicable encoding format.

d) Reference: NCV Standard (Section 5.3.5 (Table 12), Section 5.5.4.4 (Table 19))

e) Test type: Basic test

A.5.5.7.3.1 Test Module for DifferentTerms Collection or List

a) Test identifier: DifferentTermsCollectionOrList

b) Test purpose: Verify the conformance of the product with the requirement to declare an axiom for every ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) to indicate that all BasicVocabularyTerms belonging to the same ComplexVocabularyTerm are pairwise distinct. (**Mandatory**)

c) Test method: Inspect the product to determine whether every ComplexVocabularyTerm has a corresponding DifferentTerms (`owl:AllDifferent`) axiom whose declared members are exactly the members declared for that ComplexVocabularyTerm, in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.5 (Table 12 (row 1)), Section 5.5.4.4 (Table 19 (row 1)))

e) Test type: Capability test

A.5.5.7.3.2 Test Module for DistinctMembers

a) Test identifier: DistinctMembers

b) Test purpose: Verify the conformance of the product with the requirement that all BasicVocabularyTerms that are members of the same ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) shall be declared to be distinct in meaning. (**Mandatory**)

c) Test method: Inspect the product to determine that every BasicVocabularyTerm belonging to (using `skos:inScheme`) a ComplexVocabularyTerm is included in the corresponding DifferentTerms axiom for that ComplexVocabularyTerm.

d) Reference: NCV Standard (Section 5.3.5 (Table 12 (row 2)), Section 5.5.4.4 (Table 19 (row 2)))

e) Test type: Capability test

A.5.6 Test Module for Datatype Conformance

a) Test identifier: Datatypes

b) Test purpose: Verify the conformance of the product with the datatypes specified in the NSG vocabulary specification. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses the required datatypes and encodings for IRIs (A.5.6.1), DateTime (A.5.6.2), IANALanguageSubtag (A.5.6.3), Boolean (A.5.6.4), CharacterString (A.5.6.5), LocalizedCharacterString (A.5.6.6), LocalizedContinuousString (A.5.6.7), TermCategoryType (A.5.6.8), and TermStatusType (A.5.6.9) value types specified in the vocabulary specification in the NCV Standard.

d) Reference: NCV Standard (Section 5.3.6, Section 5.5.5, and Section 5.5.6)

e) Test type: Basic

A.5.6.1 Test Case for IRI Datatype

a) Test identifier: IRI

b) Test purpose: Verify the conformance of the product with the IRI datatype. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses values in the range of the required datatype `xsd:anyURI` for properties specified with the value type IRI in the NSG vocabulary information model and used in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.6.1, Section 5.5.5)

e) Test type: Basic

A.5.6.2 Test Case for DateTime

a) Test identifier: DateTime

b) Test purpose: Verify the conformance of the product with the DateTime datatype. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses values in the range of the required datatype `xsd:dateTime` for properties specified with the value type DateTime in the NSG vocabulary information model and used in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.6.2, Section 5.5.5)

e) Test type: Basic

A.5.6.3 Test Case for IANA Language Subtag

a) Test identifier: IANALanguageSubtag

b) Test purpose: Verify the conformance of the product with the use of IANALanguageSubtag code values to indicate the natural language of expressions in CharacterStrings. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses values specified in the IANA Language Subtag registry when indicating the natural language of a CharacterString with the property `xml:lang` or an '`@`' language tag, as specified in the NSG vocabulary information model and used in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.6.3, Section 5.5.5)

e) Test type: Basic

A.5.6.4 Test Case for Boolean Datatype

a) Test identifier: Boolean

b) Test purpose: Verify the conformance of the product with the Boolean datatype. (**Mandatory**)

c) Test method: Inspect the product to determine that it uses values in the range of the required datatype `xsd:boolean` for properties specified with the value type Boolean in the NSG vocabulary information model and used in the vocabulary content specified in the ICS.

d) Reference: NCV Standard (Section 5.3.6.4, Section 5.5.5)

e) Test type: Basic

A.5.6.5 Test Case for CharacterString Datatype

a) Test identifier: CharacterString

b) Test purpose: Verify the conformance of the product with the CharacterString datatype. (**Mandatory**)

c) Test method: (1) Inspect the product to determine that it uses values in the range of the required datatype `rdf:PlainLiteral` for properties specified with the value type CharacterString in the NSG vocabulary information model and used in the vocabulary content specified in the ICS. (2) Values that are character strings (*e.g.*, values of `xsd:string`) with no language tag satisfy the requirements for the value type CharacterString in the NSG vocabulary information model. (3) Optionally, a language tag may be present.

d) Reference: NCV Standard (Section 5.3.6.5, Section 5.5.5)

e) Test type: Basic

A.5.6.6 Test Case for LocalizedCharacterString Datatype

a) Test identifier: LocalizedCharacterString

b) Test purpose: Verify the conformance of the product with the LocalizedCharacterString datatype. (**Mandatory**)

c) Test method: (1) Inspect the product to determine that it uses values in the range of the required datatype `rdf:PlainLiteral` for properties specified with the value type LocalizedCharacterString in the NSG vocabulary information model and used in the vocabulary content specified in the ICS. (2) In order to satisfy the requirements for a LocalizedCharacterString in the NSG vocabulary information model, a value shall include both a character string and a language tag.

d) Reference: NCV Standard (Section 5.3.6.6, Section 5.5.5)

e) Test type: Basic

A.5.6.7 Test Case for LocalizedContinuousString Datatype

a) Test identifier: LocalizedContinuousString

b) Test purpose: Verify the conformance of the product with the LocalizedContinuousString datatype. (**Mandatory**)

c) Test method: (1) Inspect the product to determine that it uses values in the range of the required datatype `rdf:PlainLiteral` for properties specified with the value type LocalizedContinuousString in the NSG vocabulary information model and used in the vocabulary content specified in the ICS. (2) In order to satisfy the requirements for a LocalizedCharacterString in the NSG vocabulary information model, a value shall include both a character string and a language tag. (3) The string portion of the value shall not contain any space characters (unless those are encoded using '%20').

d) Reference: NCV Standard (Section 5.3.6.7, Section 5.5.5)

e) Test type: Basic

A.5.6.8 Test Case for TermCategoryType

a) Test identifier: TermCategoryType

b) Test purpose: Verify the conformance of the product with the values of TermCategoryType as specified in the NSG vocabulary specification. (**Mandatory**)

c) Test method: Inspect the vocabulary content specified in the ICS to determine that it uses values from the enumeration TermCategoryType (encoded by `ncvx:TermCategoryType`) on the required property termCategory (encoded by `ncvx:termCategory`) as specified in the NSG vocabulary specification.

d) Reference: NCV Standard (Section 5.3.6.8, Section 5.5.5; Annex D.2 (Table 24 (rows 5-11)))

e) Test type: Basic

A.5.6.9 Test Case for TermStatusType

a) Test identifier: TermStatusType

b) Test purpose: Verify the conformance of the product with the values of TermStatusType as specified in the NSG vocabulary specification. (**Mandatory**)

c) Test method: Inspect the vocabulary content specified in the ICS to determine that it uses values from the enumeration TermStatusType (encoded by `regx:ItemStatusType`) on the required property termStatus (encoded by `regx:itemStatus`) as specified in the NSG vocabulary specification.

d) Reference: NCV Standard (Section 5.3.6.9, Section 5.5.5, Annex D.3 (Table 25 (rows 1, 2, 4, 5, and 6)))

e) Test type: Basic

Annex B – ICS Pro Forma

(Normative)

B.1 *Introduction*

An Implementation Conformance Statement (ICS) is a statement made by the supplier of an implementation or system that is claimed to conform to a given standard (or a set of standards), in which it is declared which capabilities have been implemented in the product in conformance with the standard. This is especially important when there are options that may be implemented (or not), so that a tester may evaluate the conformance of an implementation against the relevant requirements. An ICS pro forma provides a uniform means for the implementer to declare the mandatory, conditional, and optional provisions of the standard that were implemented.

The Abstract Test Suite (ATS) for the NCV Standard, Edition 2.0, is a compendium of abstract test cases that provide a basis for verifying the structure and content of vocabulary content encodings conformant with the NCV Standard. Four conformance classes (A, B, C, and D) are defined in Annex A. This Annex (B) offers two ICS Pro Forma templates: one for implementations claiming Class A, B, or C conformance (use of NCV content), and one for implementations claiming Class D conformance (NSG vocabulary specification used for non-NCV content).

B.2 *ICS Pro Forma for NCV Content (Class A/B/C)*

The ICS Pro Forma for NCV Content shall be used by the supplier or sponsor of an implementation as a framework to document the standards-conformant capabilities of the implementation of this standard in conformance with Classes A, B, or C. The NCV (A/B/C) ICS Pro Forma is presented in Table 21.

The ICS Pro Forma for Class A/B/C conformance shall provide the following information:

- The **Implementation Under Test (IUT)** provides the name of the realization of a specification that is the focus of the test.
- The **Test Sponsor** information includes the name, organization, and contact information for the individual or organization that is submitting the implementation for testing.
- The **Date of Initial ICS Completion** is the date on which the Test Sponsor submitted the completed Implementation Conformance Statement.
- The **Conformance Class (A, B, or C)** designates the set of conformance requirements pertinent to the test. The IUT submitted with this Pro Forma shall conform to Class A, B, or C requirements as specified by the relevant section of the NCV Standard, Annex A.
- The **NCV Content Baseline** specifies the version number of the NCV content to which the IUT claims conformance.
- The **Supported Encoding(s)** identifies which official NCV content encoding(s) are used by the IUT, which shall be either the RDF/XML encoding or the N-Triples encoding, or both.
- The **Test Point(s)** information specifies where the test is to be applied (*e.g.*, at input or output from the implementation, or to static content).
- The **Test Organization** information includes the name of the organization, the POC, and contact information for the organization that is performing the conformance test.
- The **Date of Test Completion** is the date on which the Test Organization completed the conformance testing, including results returned to the Test Sponsor.

Table 21 – ICS Pro Forma for NCV Content (Class A/B/C)

NCV (Class A/B/C) – Implementation Conformance Statement (ICS)

Column Key: B = Baseline NCV S = Subset Obligation I = Implemented P/F = Pass/Fail

Column Values: M = Mandatory O = Optional C = Conditional

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Content Baseline (Version #):
Test Point(s):
Test Organization:
Test Sponsor:
Conformance Class (A/B/C):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
General Capabilities. The NCV content is a SKOS-based controlled vocabulary of terms intended for use in the NSG to consistently and unambiguously refer to elements of shared GEOINT in data resources and applications. NCV content is encoded in RDF/XML and/or in N-Triples. Those parameters shown on the right as 'implemented' provide an indication of the capabilities enabled by the uses of NCV content produced by the implementation under test (IUT). These parameters are informational only; the concept of pass/fail is not applicable for this characteristic.	NCV content is used to annotate data resources (*e.g.*, instance data, analytic reports, message payloads, *etc*.).	O	O		
	NCV content is used in user interfaces to specify labels and menu choices aligned with NSG controlled vocabulary (terminology).	O	O		
	NCV content is used by a terminology server to provide preferred terms, synonyms (optional), and definitions of NSG controlled vocabulary (terminology).	O	O		
	NCV content is used to index data resources.	O	O		
	NCV content is used by a search application to provide keywords and/or synonyms used to shape user queries and/or search data resources.	O	O		
	NCV content is used selectively to serve a specific mission, domain, or application.	O	O		
	NCV content is used as the basis of a vocabulary extension (*i.e.*, a set of more specialized terms consistent with the NCV, or a set of synonyms applicable to NCV terms).	O	O		
	NCV content is used to locate tagged data resources from local or remote network locations.	O	O		
	Other (Describe):	O	O		
	Other (Describe):	O	O		

NCV (Class A/B/C) – Implementation Conformance Statement (ICS)

Column Key: B = Baseline NCV S = Subset Obligation I = Implemented P/F = Pass/Fail

Column Values: M = Mandatory O = Optional C = Conditional

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Content Baseline (Version #):
Test Point(s):
Test Organization:
Test Sponsor:
Conformance Class (A/B/C):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
Conformance Classes A/B/C. The Abstract Test Suite (ATS) for the NCV Standard, Edition 2.0, Classes A, B, and C (Sections A.2, A.3, and A.4), is a compendium of abstract test cases that provide a basis for verifying the implementation of the structure and encoding of NSG Core Vocabulary content, optionally with allowable subsets or extensions. The implementation shall satisfy at least one of the four Conformance Classes, conditional on the intended capabilities of the implementation. Conformance to Classes A, B, and/or C is covered by this ICS.	Conformance Class A. NCV content utilized or produced by this implementation conforms to the complete NCV content. An implementation shall satisfy all tests in the ATS (NCV Standard, Annex A) to be conformant.	C			
	Conformance Class B. NCV content utilized or produced by this implementation contains a specified subset of a designated NCV content baseline.	C			
	Conformance Class C. NCV content utilized or produced by this implementation contains an NCV-conforming vocabulary extension. The implementation also satisfies the tests for either Conformance Class A or Conformance Class B. The vocabulary extension satisfies the tests for Conformance Class D (also submit NCV (D) ICS Pro Forma).	C			
Vocabulary Subset of NCV (Class B). A subset of NCV content can optionally be used, as permitted by the NCV Standard. When opting to use partial NCV content as a Vocabulary Subset, the parameters to the right apply.	The Vocabulary Subset is based on a single, officially published NCV content baseline (as identified in this ICS), and contains NCV terms drawn from that version only.		M		
	The Vocabulary Subset declares all vocabulary terms in the subset to be distinct. (Optional)		O		
	The IRI for each vocabulary term in the Vocabulary Subset is as specified in the NCV content baseline identified in the ICS. A specification of the vocabulary terms included in the Vocabulary Subset is provided by reference or copy.		M		
	The term category of each term in the Vocabulary Subset is as specified in the NCV content baseline identified in the ICS.		M		

NCV (Class A/B/C) – Implementation Conformance Statement (ICS)

Column Key: **B = Baseline NCV** **S = Subset Obligation** **I = Implemented** **P/F = Pass/Fail**

Column Values: **M = Mandatory** **O = Optional** **C = Conditional**

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Content Baseline (Version #):
Test Point(s):
Test Organization:
Test Sponsor:
Conformance Class (A/B/C):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
	All mandatory documentation properties for vocabulary terms are included as specified in the NCV content baseline identified in the ICS.		M		
	For each AttributeTerm and EntityTerm included in the Vocabulary Subset that has declared relationships to a CollectorTerm in the specified NCV content baseline, those relationships and that CollectorTerm are optionally included in the Vocabulary Subset.		O		
	All pairs of AttributeTerms and EntityTerms included in the Vocabulary Subset which have hierarchical relationships (broader/narrower) declared between them in the specified NCV content baseline optionally have those hierarchical relationships included in the Vocabulary Subset. (Optional)		O		
	Each ListedValueTerm included in the Vocabulary Subset has the declared relationships to its EnumeratedTypeTerm as specified in the NCV content baseline (*i.e.*, memberTermOf and, if applicable, topTermOf), with the EnumeratedTypeTerm also included in the Vocabulary Subset.		M		
	For each EnumeratedTypeTerm included in the Vocabulary Subset that has a hierarchical set of ListedValueTerm members, all broader and narrower term relationships between the member ListedValueTerms are included in the Vocabulary Subset as specified in the NCV content baseline.		M		
	The Vocabulary Subset indicates for each included ComplexTerm (CollectorTerm or EnumeratedTypeTerm) whether its membership is complete (closed and non-extensible) or incomplete (open and extensible), using domainComplete as specified in the NCV content baseline identified in the ICS.		M		

NCV (Class A/B/C) – Implementation Conformance Statement (ICS)

Column Key: B = Baseline NCV S = Subset Obligation I = Implemented P/F = Pass/Fail

Column Values: M = Mandatory O = Optional C = Conditional

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Content Baseline (Version #):
Test Point(s):
Test Organization:
Test Sponsor:
Conformance Class (A/B/C):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
	For each ComplexTerm (CollectorTerm or EnumeratedTypeTerm) included in the Vocabulary Subset, all of its member terms declared in the NCV content baseline are also included in the Vocabulary Subset, along with the applicable topTermOf relationships.		M		
	For each ComplexTerm (CollectorTerm or EnumeratedTypeTerm) included in the Vocabulary Subset, its DifferentTerms axiom as specified in the NCV content baseline shall also be included.		M		
	The Vocabulary Subset includes only vocabulary terms whose termStatus value is ‘valid’ as specified in the NCV content baseline identified in the ICS. (Optional)		O		
	The Vocabulary Subset excludes all predecessorTerm and successorTerm relationships. (Conditional on the option of including only ‘valid’ terms)		C		
	Approved Vocabulary Subsets should be published in the NSG Standards Registry to support interoperability and re-use.		C		
	Other (Describe):		O		
	Other (Describe):		O		

NCV (Class A/B/C) – Implementation Conformance Statement (ICS)

Column Key: B = Baseline NCV S = Subset Obligation I = Implemented P/F = Pass/Fail

Column Values: M = Mandatory O = Optional C = Conditional

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Content Baseline (Version #):
Test Point(s):
Test Organization:
Test Sponsor:
Conformance Class (A/B/C):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
Vocabulary Extensions with NCV (Class C). NCV content can optionally be used with a conforming Vocabulary Extension, as permitted by the NCV Standard. When opting to use the NCV content with a Vocabulary Extension, the parameters to the right apply to the Vocabulary Extension. Note that the IUT shall also be conformant with either an identified NCV content baseline or an identified NCV Vocabulary Subset of the NCV.	Each Vocabulary Extension shall import either the entire NCV content from the specified baseline or a valid Vocabulary Subset.	M	M		
	If the IUT is an application or service, then the implementation shall satisfy the ATS tests for either Conformance Class A or Conformance Class B, as applicable to the imported NCV content specified in the ICS. Vocabulary Extension is used with: ___ NCV Baseline (complete) ___ NCV Vocabulary Subset	C	C		
	The Vocabulary Extension shall be assigned a URI base different from that of the NCV. Identify URI base for the Vocabulary Extension: (Vocabulary Extension is retrievable from URI or is provided separately.)	M	M		
	New (non-NCV) vocabulary terms and/or properties belonging to the Vocabulary Extension shall be assigned IRIs in the namespace of the Vocabulary Extension.	M	M		
	Except for the use of a different URI base, the Vocabulary Extension shall conform to the NSG vocabulary information model that is specified in the NCV Standard, Section 5.3, and be available in a SKOS-based encoding as specified in the NCV Standard, Section 5.5.	M	M		
	The Vocabulary Extension shall not contain any term that is equivalent in meaning to a vocabulary term defined in the NCV content.	M	M		
	The Vocabulary Extension may contain new aliases (using `skos:altLabel`) for NCV vocabulary terms.	O	O		

NCV (Class A/B/C) – Implementation Conformance Statement (ICS)

Column Key: B = Baseline NCV S = Subset Obligation I = Implemented P/F = Pass/Fail

Column Values: M = Mandatory O = Optional C = Conditional

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Content Baseline (Version #):
Test Point(s):
Test Organization:
Test Sponsor:
Conformance Class (A/B/C):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
	Hierarchical relationships are declared between new (non-NCV) vocabulary terms in the Vocabulary Extension and vocabulary terms in the NCV content baseline specified in the ICS. (Optional)	O	O		
	If new BasicVocabularyTerms are defined in the namespace of the Vocabulary Extension and declared to be members of an open NCV ComplexTerm (*i.e.*, one with domainComplete = 'FALSE'), then the Vocabulary Extension shall declare a DifferentTerms axiom including all the members of the ComplexTerm, including all the new members defined in the Vocabulary Extension as well as all the members defined in the NCV content baseline specified in the ICS.	C	C		
	General conformance of the content of the Vocabulary Extension to the NSG vocabulary specification should be tested according to Class D conformance.	O	O		
	Approved Vocabulary Extensions should be published in the NSG Standards Registry to support future potential integration with the NCV Standard, and to support interoperability in general.	O	O		
	Other (Describe):	O	O		
	Other (Describe):	O	O		

B.3 *ICS Pro Forma for the NSG Vocabulary Specification (Class D)*

The ICS Pro Forma for the NSG Vocabulary Specification shall be used by the supplier or sponsor of an implementation as a framework to document the standards-conformant capabilities of the implementation of this standard in conformance with Class D. The NCV (D) ICS Pro Forma is presented in Table 22.

The ICS Pro Forma for Class D conformance shall provide the following information:

- The **Implementation Under Test (IUT)** provides the name of the realization of a specification that is the focus of the test.

- The **Test Sponsor** information includes the name, organization, and contact information for the individual or organization that is submitting the implementation for testing.
- The **Date of Initial ICS Completion** is the date on which the Test Sponsor submitted the completed Implementation Conformance Statement.
- The **Conformance Class (D)** designates the set of conformance requirements pertinent to the test. The IUT submitted with this Pro Forma shall conform to Class D requirements as specified by Section A.5 of the NCV Standard.
- The **NCV Edition #** identifies the edition of the NCV Standard that contains the NSG vocabulary specification to which the IUT claims conformance.
- The **Vocabulary IRI (URI Base)** specifies the vocabulary IRI that designates the vocabulary content for which the IUT claims conformance to the NSG vocabulary specification. This IRI provides the URI base for the IRIs of all vocabulary terms in the vocabulary content.
- The **Vocabulary Version # or Date** specifies the version number or date of the vocabulary content for which the IUT claims conformance to the NSG vocabulary specification.
- The **Supported Encoding(s)** identifies which vocabulary encoding(s), specified in the NCV Standard, are used by the IUT, which shall be either the RDF/XML encoding or the N-Triples encoding, or both.
- The **Test Point(s)** information specifies where the test is to be applied (*e.g.*, at input or output from the implementation, or to static content).
- The **Test Organization** information includes the name of the organization, the POC, and contact information for the organization that is performing the conformance test.
- The **Date of Test Completion** is the date on which the Test Organization completed the conformance testing, including results returned to the Test Sponsor.

Table 22 – ICS Pro Forma for NSG Vocabulary Specification (Class D)

NCV (Class D) – Implementation Conformance Statement (ICS)

Column Key: B = Baseline NCV S = Subset Obligation I = Implemented P/F = Pass/Fail

Column Values: M = Mandatory O = Optional C = Conditional

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Edition #:
Vocabulary Version # or Date:
Test Point(s):
Test Organization:

Test Sponsor:
Conformance Class: D
Vocabulary IRI (URI Base):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
General Capabilities. The NSG vocabulary specification defines an information model and a SKOS-based encoding for creating a controlled vocabulary of terms intended for use in the NSG to consistently and unambiguously refer to elements of shared GEOINT in data resources and applications. The vocabulary	The vocabulary content is used to annotate data resources (e.g., instance data, analytic reports, message payloads, *etc*.).	O			
	The vocabulary content is used in user interfaces to specify labels and menu choices aligned with the controlled vocabulary (terminology).	O			
	The vocabulary content is used by a terminology server to provide preferred terms, synonyms (optional), and definitions from the controlled vocabulary (terminology).	O			

NCV (Class D) – Implementation Conformance Statement (ICS)

Column Key: B = Baseline NCV S = Subset Obligation I = Implemented P/F = Pass/Fail

Column Values: M = Mandatory O = Optional C = Conditional

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Edition #:
Vocabulary Version # or Date:
Test Point(s):
Test Organization:

Test Sponsor:
Conformance Class: D
Vocabulary IRI (URI Base):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
content is encoded in RDF/XML and/or N-Triples. Those parameters shown on the right as 'implemented' provide an indication of the capabilities enabled by the uses of the vocabulary content produced by the implementation under test. These parameters are informational only; the concept of pass/fail is not applicable for this characteristic.	The vocabulary content is used to index data resources.	O			
	The vocabulary content is used by a search application to provide keywords and/or synonyms used to shape user queries and/or search data resources.	O			
	The vocabulary content is used to serve a specific mission, domain, or application.	O			
	The vocabulary content is used to locate tagged data resources from local or remote network locations.	O			
	The vocabulary content is proposed as a component vocabulary of the NSG Enterprise Vocabulary (NEV). The vocabulary content satisfies the tests for both Conformance Class D and Conformance Class C (also submit the NCV (A/B/C) ICS Pro Forma) plus the special conditions in the NCV Standard, Annex C.5 (NEV Conformance).	O			
	Other (Describe):	O			
	Other (Describe):	O			

NCV (Class D) – Implementation Conformance Statement (ICS)

Column Key: **B = Baseline NCV** **S = Subset Obligation** **I = Implemented** **P/F = Pass/Fail**

Column Values: **M = Mandatory** **O = Optional** **C = Conditional**

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Edition #:
Vocabulary Version # or Date:
Test Point(s):
Test Organization:

Test Sponsor:
Conformance Class: D
Vocabulary IRI (URI Base):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
Conformance Class D. The Abstract Test Suite (ATS) for the NCV Standard, Edition 2.0, Class D (Section A.5), is a compendium of abstract test cases that provide a basis for verifying the structure and content of a controlled vocabulary defined and encoded in conformance with the NSG vocabulary specification. The implementation shall satisfy at least one of the four Conformance Classes, conditional on the intended capabilities of the implementation. Conformance to Class D is covered by this ICS.	Conformance Class D. Vocabulary content specified by this implementation conforms to the NSG vocabulary specification. The implementation shall satisfy all tests in the ATS (NCV Standard, Annex A), Class D, to be conformant.	C			
Vocabulary Conformant to the NSG Vocabulary Specification (Class D). A controlled vocabulary can be specified in accordance with the NSG vocabulary information model and encoding guidance established in the NCV Standard. When developing a vocabulary conformant to the NSG vocabulary specification, the parameters to the right apply.	The vocabulary content conforms to the NSG vocabulary specification published in an identified official edition of the NCV Standard.	M			
	The vocabulary (*i.e.*, the collection of all the vocabulary content) has been assigned a single IRI that is used as the URI base for all of the IRIs for vocabulary terms in the vocabulary content.	M			
	The vocabulary (collection of all the vocabulary content) has values for all resource documentation properties required by the NSG vocabulary specification.	M			
	The vocabulary content is provided for testing, either by reference (*e.g.*, retrieval from the IRI) or by copy.	M			

NCV (Class D) – Implementation Conformance Statement (ICS)

Column Key: B = Baseline NCV S = Subset Obligation I = Implemented P/F = Pass/Fail

Column Values: M = Mandatory O = Optional C = Conditional

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Edition #:
Vocabulary Version # or Date:
Test Point(s):
Test Organization:

Test Sponsor:
Conformance Class: D
Vocabulary IRI (URI Base):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
	All dependencies of the vocabulary content on external standards and namespaces have been identified as required by the NSG vocabulary specification.	M			
	All mandatory documentation properties for vocabulary terms are assigned values for each term in the vocabulary content.	M			
	For each term in the vocabulary content, a single term category is specified in accordance with the TermCategoryTypes in the NCV vocabulary specification.	M			
	All mandatory metadata properties for recording term status are assigned values for each term in the vocabulary content.	M			
	If all vocabulary terms are declared pairwise distinct, then the vocabulary contains an AllDifferentTerms axiom as specified in the NSG vocabulary specification.	C			
	Each member of a CollectorTerm included in the vocabulary content has the required relationships to its CollectorTerm as specified in the NSG vocabulary information model (*i.e.*, memberTermOf and, if applicable, topTermOf), with the CollectorTerm also included in the vocabulary content.	M			
	Hierarchical relationships (*i.e.*, broader and narrower) between vocabulary terms relate only terms having the same value of term category.	M			
	Each ListedValueTerm included in the vocabulary content has the required relationships to its EnumeratedTypeTerm as specified in the NSG vocabulary information model (*i.e.*, memberTermOf and, if applicable, topTermOf), with the EnumeratedTypeTerm also included in the vocabulary content.	M			

NCV (Class D) – Implementation Conformance Statement (ICS)

Column Key: B = Baseline NCV S = Subset Obligation I = Implemented P/F = Pass/Fail

Column Values: M = Mandatory O = Optional C = Conditional

Implementation Under Test (IUT):
Date of Initial ICS Completion:
NCV Edition #:
Vocabulary Version # or Date:
Test Point(s):
Test Organization:

Test Sponsor:
Conformance Class: D
Vocabulary IRI (URI Base):
Supported Encodings (RDF/XML and/or N-Triples):
Date of Test Completion:

Characteristic	Parameter	Obligation			
		B	S	I	P/F
	Each ComplexVocabularyTerm (CollectorTerm or EnumeratedTypeTerm) included in the vocabulary content has all of its member vocabulary terms declared in the vocabulary content, along with the applicable topTermOf relationships.	M			
	Each ComplexVocabularyTerm in the vocabulary content is declared to have its membership either complete (closed and non-extensible) or incomplete (open and extensible), using domainComplete as required in the NSG vocabulary specification.	M			
	For each ComplexVocabularyTerm included in the vocabulary content that has a hierarchical set of members, all broader and narrower term relationships (with related member vocabulary terms) are included in the vocabulary content specified in the ICS.	M			
	For each ComplexVocabularyTerm included in the vocabulary content, an associated DifferentTerms axiom shall also be included.	M			
	The vocabulary content conforms to the use of datatypes in the NSG vocabulary specification.	M			
	The vocabulary content meets the additional conditions in the NCV Standard, Annex C.5, for NEV Conformance.	C			
	Other (Describe):	O			
	Other (Describe):	O			
	Other (Describe):	O			
	Other (Describe):	O			
	Other (Describe):	O			

Annex C – NSG Enterprise Vocabulary (NEV) Specification

(Normative)

C.1 *Introduction*

The NSG Enterprise Vocabulary (NEV) is a collection of controlled vocabularies, including the NSG Core Vocabulary (NCV), which conform to the NSG vocabulary specification and which may be used together to describe geospatial intelligence (GEOINT) shared in the National System for Geospatial Intelligence (NSG). A vocabulary that conforms to the NSG vocabulary specification conforms to the NSG vocabulary information model, IRI requirements, and encoding guidance as published in the NCV Standard. Each vocabulary term in the NEV is unique with respect to its IRI, name, and definition.

A vocabulary included in the NEV is referred to as a “component vocabulary”. The criteria for including a specific vocabulary in the NEV are determined by NSG requirements.

This Annex specifies the IRIs for NEV resources, including NEV component vocabularies based on the content of the Information Resources Registry of the NSG Standards Registry (Section C.3). The encoded NEV content is available from the NEV home page at: http://nsgreg.nga.mil/nev

C.2 *Information Model*

Each controlled vocabulary included in the NEV shall conform to the NSG vocabulary information model specified in the NCV Standard, Section 5.3, and be evaluated in accordance with Conformance Class D (Section A.5).

C.3 *Identifiers (IRIs)*

The IRIs for NEV component vocabularies and their constituent terms are constructed in accordance with the patterns specified in the NCV Standard, Section 5.5.2.2 (vocabulary IRIs) and Section 5.5.2.3 (vocabulary term IRIs).

The pattern for a vocabulary IRI is:

protocol "://" *domain* "/" *resource-type* "/" *resource*

where each segment is case-sensitive and determined as follows:

- *protocol* – always 'http'
- *domain* –'api.nsgreg.nga.mil' for NSG vocabularies
- *resource-type* – always 'vocabulary'
- *resource* – designation for a specific resource (*e.g.*, 'ncv' for NCV, ‘nev’ for NEV)

The IRI for the NEV resource is http://api.nsgreg.nga.mil/vocabulary/nev. The retrieved file contains the encoded list of NEV component vocabularies.

The IRI for the NEV resource is not used as the URI base for any vocabulary terms. The NEV consists of the set of component vocabularies. While the NEV collects terms from the component vocabularies, each vocabulary term has an IRI specific to the component vocabulary in which it is defined.

Each component vocabulary IRI has its own final (*resource*) segment, based on the name of the vocabulary. The names and identifiers established for the component vocabularies of the NSG Enterprise Vocabulary are listed in Table 23. Each vocabulary also has a three-letter code used in the Register.

Table 23 – IRIs for NEV Component Vocabularies

Vocabulary Name	Resource IRI	Code
NSG Belief Systems Vocabulary	http://api.nsgreg.nga.mil/vocabulary/belief-system	BSV
NSG Codelists Vocabulary	http://api.nsgreg.nga.mil/vocabulary/codelist	CDV
NSG Core Vocabulary	http://api.nsgreg.nga.mil/vocabulary/ncv	NCV
NSG Linguistic Entities Vocabulary	http://api.nsgreg.nga.mil/vocabulary/linguistic-entity	LEV
NSG Physical Quantities Vocabulary	http://api.nsgreg.nga.mil/vocabulary/physical-quantity	PQV
NSG Quality Measures Vocabulary	http://api.nsgreg.nga.mil/vocabulary/quality-measure	QMV
NSG Spatiotemporal Reference Systems Vocabulary	http://api.nsgreg.nga.mil/vocabulary/coord-ref-system	SRV

The pattern for a vocabulary term IRI is:

protocol "://" *domain* "/" *resource-type* "/" *resource* "/" [context "/"] *concept*

where each segment is case-sensitive and determined as follows:

- *protocol* – always 'http'
- *domain* –'api.nsgreg.nga.mil' for NSG vocabulary terms
- *resource-type* – always 'vocabulary'
- *resource* – designation for a specific resource (*e.g.*, 'ncv' for NCV content; 'quality-measure' for NSG Quality Measures Vocabulary)
- *context* – designates an EnumeratedTypeTerm (*e.g.*, 'AccessibilityStatusTermSet') to which a ListedValueTerm (*e.g.*, 'restricted') belongs, and which is the context for understanding the *concept*.
- *concept* – designates an individual vocabulary term (*e.g.*, 'Aerial', 'Building', 'MountainPass', 'restricted')

The individual segments are concatenated into a single string as specified by the pattern (above), to form the IRI that designates the vocabulary term.

C.4 *Content Encodings*

The NCV Standard, Section 5.5, defines an encoding specification for the NSG vocabulary information model, based on the W3C Simple Knowledge Organization System (SKOS), that shall be used for the encoding of any controlled vocabulary included as an NEV component vocabulary.

C.5 *Conformance*

Conformance is specified for NEV component vocabularies. For the NEV (IRI: http://api.nsgreg.nga.mil/vocabulary/nev), see Section C.7 on Publication.

The NCV is an NEV component vocabulary that conforms to the NCV ATS Class A (Section A.2).

Each non-NCV NEV component vocabulary shall conform to both the NCV ATS Class C (Section A.4) and Class D (Section A.5), with the following additional conditions:

1. Each NEV component vocabulary has a vocabulary IRI (URI base) authorized by the GCSB. The current set of approved IRIs is listed in Table 23.
2. Each NEV component vocabulary shall follow the guidance provided in the *Style Guide for Vocabularies in the National System for Geospatial Intelligence (NSG)*, NGA.SIG.0030_1.0_VSTY (http://nsgreg.nga.mil/doc/view?i=4550).
3. The spelling conventions followed are those of the Oxford English Dictionary, 6th Edition, Version 3.0.2.1, unless otherwise authorized by the GCSB.

C.6 *Governance*

The NSG controlled vocabularies included in the NEV shall conform to the governance process established by NGA and executed by the GEOINT Content Standards Board (GCSB), in accordance with the governance procedures specified in the NCV Standard (Section 6).

C.7 *Publication*

The NSG Enterprise Vocabulary is published in content baselines that are available as registered resources in the online NSG-unique Standards Register of the NSG Standards Registry. Individual NEV content baselines are available from the NEV home page (http://nsgreg.nga.mil/nev). Each NEV content baseline consists of a Document Set that includes the NEV encoding file together with the encoding files for each of the NEV component vocabularies. The NEV encoding file specifies the list of component vocabularies. The NEV content comprises all vocabulary terms from the NEV component vocabularies. NEV content baselines are versioned when a component vocabulary is added or removed from the NEV, or when the content of a component vocabulary changes. NEV content baselines are versioned using a two-part version number in which the first part identifies the applicable edition of the NCV Standard, while the second part specifies a monotonically increasing integer value (*e.g.*, '1-6' or '2-1').

The complete list of the latest NEV component vocabularies is accessible online using the non-versioned NEV IRI (http://api.nsgreg.nga.mil/vocabulary/nev). NEV content is available online in the registers for individual NEV components in the NSG Standards Registry. Individual vocabulary terms are retrievable through the REST API component of the NSG Standards Registry.

The content of the NEV is also published in an informative Excel workbook containing only valid vocabulary terms that is published with each NEV content baseline.

Annex D – Utility Ontologies for NSG Controlled Vocabularies

(Normative)

D.1 *Introduction*

Two utility ontologies encoded in OWL (RDF/XML) define concepts needed for representing information in the NSG GEOINT Content Semantic Resources (GCSR) encoded in the W3C Web Ontology Language (OWL) and Simple Knowledge Organization System (SKOS). The namespaces and topics for these two ontologies are:

A. 'ncvx' – An ontology that defines specialized concepts used in defining NSG vocabulary terms.

B. 'regx' – An ontology that defines resource-management concepts for use in describing the lifecycle status of NSG vocabulary terms and relationships to predecessor or successor terms.

D.2 *Concepts in the NSG Vocabulary Auxiliary Ontology (NCVX)*

The NSG Vocabulary Auxiliary Ontology (NCVX) defines additional concepts to be used with NSG vocabularies represented in SKOS in accordance with the vocabulary specification of the NCV Standard (Section 5). The concept VocabularyTerm is defined in the NCVX. This concept formalizes the inclusion of both `skos:Concept` and `skos:ConceptScheme` constructs in the representation of vocabulary terms in NSG vocabularies. While SKOS contains semantic relations (*e.g.*, `skos:broader`, `skos:narrower`) that may be used to relate pairs of `skos:Concept`, the NCVX defines additional properties that may be used to relate pairs of `skos:ConceptScheme`.

The NCVX supports an important characteristic of NSG vocabularies that reflects their roots in the feature-concept dictionaries defined in the ISO 19100-series *Geospatial information* standards. Distinctions between types of terms defined in ISO 19126:2009 (Section 4.1) are represented by TermCategoryType and its enumerants.

The NCVX utility ontology corresponds to the content of the 'ncvx' namespace. IRIs for official content baselines of the NCVX ontology are versioned. For convenience, use of the non-versioned IRI identifies the latest version.

A. IRI for NCVX (versioned): http://api.nsgreg.nga.mil/ontology/ncvx/2.0

B. IRI for NCVX (non-versioned): http://api.nsgreg.nga.mil/ontology/ncvx

Concepts defined in the NCVX ontology are presented in Table 24 below, together with their sources. IRIs for the ontology concepts are formed by concatenating the ontology IRI with the "/" delimiter, followed by the Concept Designation listed in the table.

Table 24 – Concepts in the NCVX Ontology (v2.0)

Ref #	Concept Designation	OWL Construct	Concept Definition	Source
1	VocabularyTerm	Class	A vocabulary term is a defined lexical item (that is, a word, phrase, or abbreviation) which represents a concept that describes real-world phenomena. NOTE: Defined as the disjoint union of `ncvx:BasicVocabularyTerm` and `ncvx:ComplexVocabularyTerm`.	NSG Core Vocabulary (NCV) Standard, Ed. 2.0, Section 5.3.3, Table 4 (row 1)
2	BasicVocabularyTerm	Class	A vocabulary term that represents a concept of a single type, aspect, relationship, or value that is used to describe real-world phenomena. EXAMPLES: Body of Water (entity), Depth (attribute), Physical Condition Term Set (value domain), Damaged (value), Linguistic Entities (subject domain).	NSG Core Vocabulary (NCV) Standard, Ed. 2.0, Section 5.3.3, Table 5 (row 1)
3	ComplexVocabularyTerm	Class	A vocabulary term that represents a concept that describes a domain of related types or values that may be used to describe real-world phenomena. EXAMPLES: (Subject domain) Physical Quantity Terms, a collection of terms each member of which denotes a property of a phenomenon, body, or substance, where the property has a magnitude that can be expressed by means of a number and a reference. (Value domain) Visible Light Type, a color-value domain consisting of a set of possible color values applicable to appearances of real-world phenomena.	NSG Core Vocabulary (NCV) Standard, Ed. 2.0, Section 5.3.3, Table 6 (row 1)
4	domainComplete	Datatype Property	An indicator as to whether the set of basic vocabulary terms belonging to the domain denoted by a complex vocabulary term includes all the possible members of that domain, with TRUE meaning 'complete' and FALSE meaning 'not complete'.	ISO 19103:2015, 6.5.1 Enumerations and codelists – General rules
5	termCategory	Object Property	The type of a vocabulary term, indicating whether the term represents a concept that describes an entity, an attribute, a single value (in a value domain), a value domain (of possible attribute values), or a subject domain (of entity and/or attributes types).	NCV Standard, Ed. 2.0, Section 5.3.3, Table 4 (row 8)

Ref #	Concept Designation	OWL Construct	Concept Definition	Source
6	TermCategoryType	Class	The set of coded domain values that specify the kind of concept represented by a particular vocabulary term.	NCV Standard, Ed. 2.0, Section 5.3.6.8
7	TermCategoryType/entity	Named Individual	The term represents a concept of a type of real-world phenomenon (for example: bridge, mountain, or event).	ISO 19126:2009, 4.1.11 (*feature concept*)
8	TermCategoryType/attribute	Named Individual	The term represents a concept that describes a characteristic of an entity.	ISO 19126:2009, 4.1.8 (*feature attribute*)
9	TermCategoryType/listedValue	Named Individual	The term represents a concept that describes a value from an enumerated type.	ISO 19126:2009, 4.1.18 (*nominal value*)
10	TermCategoryType/collector	Named Individual	The term represents a concept of a subject domain that describes a set of specialized vocabulary terms.	ISO 19126:2009, 6.2.2 (scope)
11	TermCategoryType/enumeratedType	Named Individual	The term represents a concept that describes a value domain consisting of a set of possible values for a property of an entity.	ISO 19126:2009, 4.1.22 (*value domain*)
12	broaderComplex	Object Property	A vocabulary term that is more general in meaning than this vocabulary term.	NCV Standard, Ed. 2.0, Table 6 (row 3)
13	narrowerComplex	Object Property	A vocabulary term that is more specific in meaning than this vocabulary term.	NCV Standard, Ed. 2.0, Table 6 (row 4)
14	broaderComplexTransitive	Object Property	One or more vocabulary terms that are more general in meaning than this vocabulary term by virtue of transitivity.	NCV Standard, Ed. 2.0, Section 5.3.3
15	narrowerComplexTransitive	Object Property	One or more vocabulary terms that are more specific in meaning than this vocabulary term by virtue of transitivity.	NCV Standard, Ed. 2.0, Section 5.3.3

D.3 *Concepts in the NSG Register Auxiliary Ontology (REGX)*

The NSG Register Auxiliary Ontology (REGX) defines additional concepts to be used with NSG semantic resources formalized in OWL or SKOS. REGX defines important metadata concepts (*e.g.*, *itemStatus*, *dateAccepted*, *dateOfLastChange*) for describing the management of NSG semantic resources. These concepts are based on a selection from the registry-item management concepts defined in ISO 19135-1:2015.

The REGX utility ontology corresponds to the content of the 'regx' namespace. IRIs for official content baselines of the REGX ontology are versioned. For convenience, use of the non-versioned IRI identifies the latest version.

1. IRI for REGX (versioned): http://api.nsgreg.nga.mil/ontology/regx/1.0
2. IRI for REGX (non-versioned): http://api.nsgreg.nga.mil/ontology/regx

Concepts defined in the REGX ontology are presented in Table 25 below, together with their sources. IRIs for the ontology concepts are formed by concatenating the ontology IRI with the "/" delimiter, followed by the Concept Designation listed in the table.

Table 25 – Concepts in the REGX Ontology (v1.0)

Ref #	Concept Designation	OWL Construct	Concept Definition	Source
1	itemStatus	Object Property	The standing of an item with respect to inclusion in a managed resource.	ISO 19135-1:2015, 7.5.2 (status)
2	ItemStatusType	Class	A coded domain value describing the standing of an item with respect to inclusion in a managed resource.	ISO 19135-1:2015, 7.5.2 (RE_ItemStatus)
3	ItemStatusType/submitted	Named Individual	The item has been entered into the register, but the control body has not accepted the proposal to add it. The item is not recommended for use.	ISO 19135-1:2015, 7.5.2 (submitted)
4	ItemStatusType/valid	Named Individual	The item has been accepted, is recommended for use, and has not been superseded or retired.	ISO 19135-1:2015, 7.5.2 (valid)
5	ItemStatusType/superseded	Named Individual	The item has been replaced by another item and is no longer recommended for use.	ISO 19135-1:2015, 7.5.2 (superseded)
6	ItemStatusType/retired	Named Individual	A decision has been made that the item is no longer recommended for use. It has not been superseded by another item.	ISO 19135-1:2015, 7.5.2 (retired)
7	ItemStatusType/invalid	Named Individual	A decision has been made that a previously valid register item contains a substantial error and is invalid, and will normally have been replaced by a corrected item.	ISO 19135-1:2015, 7.5.2 (invalid)
8	dateAccepted	Datatype Property	The date and (optionally) time on which an approved item was initially included in a managed resource.	ISO 19135-1:2015, B.2.3.2 (dateAccepted)
9	dateAmended	Datatype Property	The date and (optionally) time on which an item was superseded or retired in a managed resource.	ISO 19135-1:2015, B.2.3.2 (dateAmended)
10	dateOfLastChange	Datatype Property	The date and time of the most recent change made to a managed resource.	ISO 19135-1:2015, 7.2.2 (dateOfLastChange)
11	versionDate	Datatype Property	The date associated with the official publication of a specific version of a managed resource.	ISO 19135-1:2015, B.2.2.4 (versionDate)
12	versionNumber	Datatype Property	A structured character sequence that specifies a unique state in the life of a managed resource according to a specified versioning scheme.	ISO 19135-1:2015, B.2.2.4 (versionNumber)

Ref #	Concept Designation	OWL Construct	Concept Definition	Source
13	predecessor	Object Property	One or more previously valid resources that were replaced by this resource.	ISO 19135-1:2015, 7.5.2 (predecessor)
14	successor	Object Property	One or more resource(s) that replaced this previously valid resource.	ISO 19135-1:2015, 7.5.2 (successor)

D.4 *Publication of NCVX and REGX*

The NCVX and REGX utility ontologies corresponding to the content of the 'ncvx' and 'regx' namespaces, respectively, are available through the REST API component of the NSG Standards Registry. These ontologies are versioned for official use. Use of the non-versioned URL returns the latest version.

URLs for the NSG Vocabulary Auxiliary Ontology (NCVX):

- URL for NCVX (versioned): http://api.nsgreg.nga.mil/ontology/ncvx/2.0
- URL for NCVX (non-versioned): http://api.nsgreg.nga.mil/ontology/ncvx

URLs for the NSG Register Auxiliary Ontology (REGX):

- URL for REGX (versioned): http://api.nsgreg.nga.mil/ontology/regx/1.0
- URL for REGX (non-versioned): http://api.nsgreg.nga.mil/ontology/regx/1.0

Individual terms may be retrieved through the REST API.

Annex E – Inspecting the NCV Content

(Informative)

E.1 *Introduction*

The vocabulary terms specified in the NCV content are managed in the online NCV Register of the NSG Standards Registry. The NCV content is represented using the Simple Knowledge Organization System (SKOS) in accordance with the NSG vocabulary information model specified in the NCV Standard. The NCV content is encoded in both RDF/XML and N-Triples format. The primary purpose of NCV encodings is to provide machine-processable semantic information for use by applications and data in the NSG. While this includes English-language material for presentation to humans using applications, the encodings themselves are large files not especially amendable to human consumption.

There are three forms and accompanying methods that may be used to examine the NCV content:

1. NCV Register (user interface)
2. NCV encodings (RDF/XML or N-Triples format)
3. NCV content baseline workbook

Although this Annex does not present a tutorial, the following sections illustrate some ways to examine NCV content in each of the above forms with different tools.

E.2 *Using the NCV Register*

The National System for Geospatial Intelligence (NSG) Core Vocabulary (NCV) exists as an online information resource maintained by the U.S. National Center for Geospatial Intelligence Standards (NCGIS). The NCV is realized as one of a set of registers within the NSG Standards Registry. The NSG Standards Registry is located at http://nsgreg.nga.mil/. Register content is searchable and browsable in the user interface.

The evolving NCV content is published online in the NSG Core Vocabulary (NCV) Register of the NSG Standards Registry (http://nsgreg.nga.mil/voc/registers.jsp?register=NCV). Entries in the NCV Register are NCV-conformant vocabulary terms (*i.e.*, defined lexical items), accompanied by their status in the vocabulary (Section 5.3.6.9) and lineage metadata.

Vocabulary terms specified in the NCV content are managed in the online NCV Register. When all the registered vocabulary terms are collected and published as a normative technical artifact, that collection is identified as a "content baseline". The content of the NCV Register spans multiple content baselines. The Browse and Search capabilities of the NSG Standards Registry may be used with term type and date parameters to review the content of the current NCV content baseline and/or prior content baselines.

Figure 13 on the next page shows the NSG Vocabulary Registry landing page with the NCV Register selected from the left-hand menu. From there, the user chooses whether to browse or search the NCV content, which can be filtered by item (*i.e.*, term) type (Entity, Attribute, Listed Value, or Enumerated Type[30]) and status.

[30] The NCV content does not contain CollectorTerms. That term category is used by other NSG vocabularies.

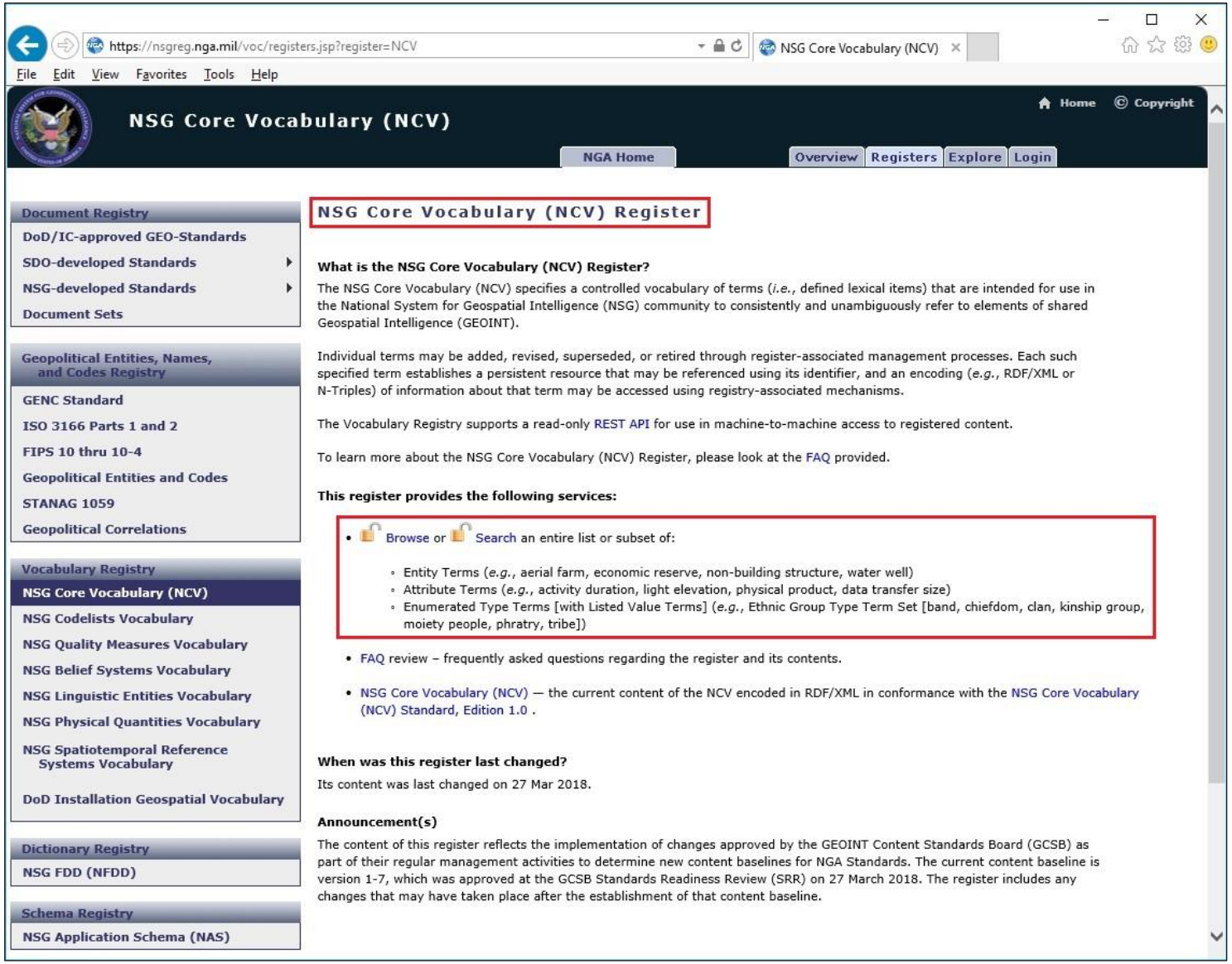


Figure 13 – NCV Register Browse/Search Web Page

In the NCV Register entry page for a term, the structured sections of the definitionNote of the vocabulary term are displayed in separate sections of the entry. Figure 14 shows an example using the AttributeTerm “Height Above Surface Level”.

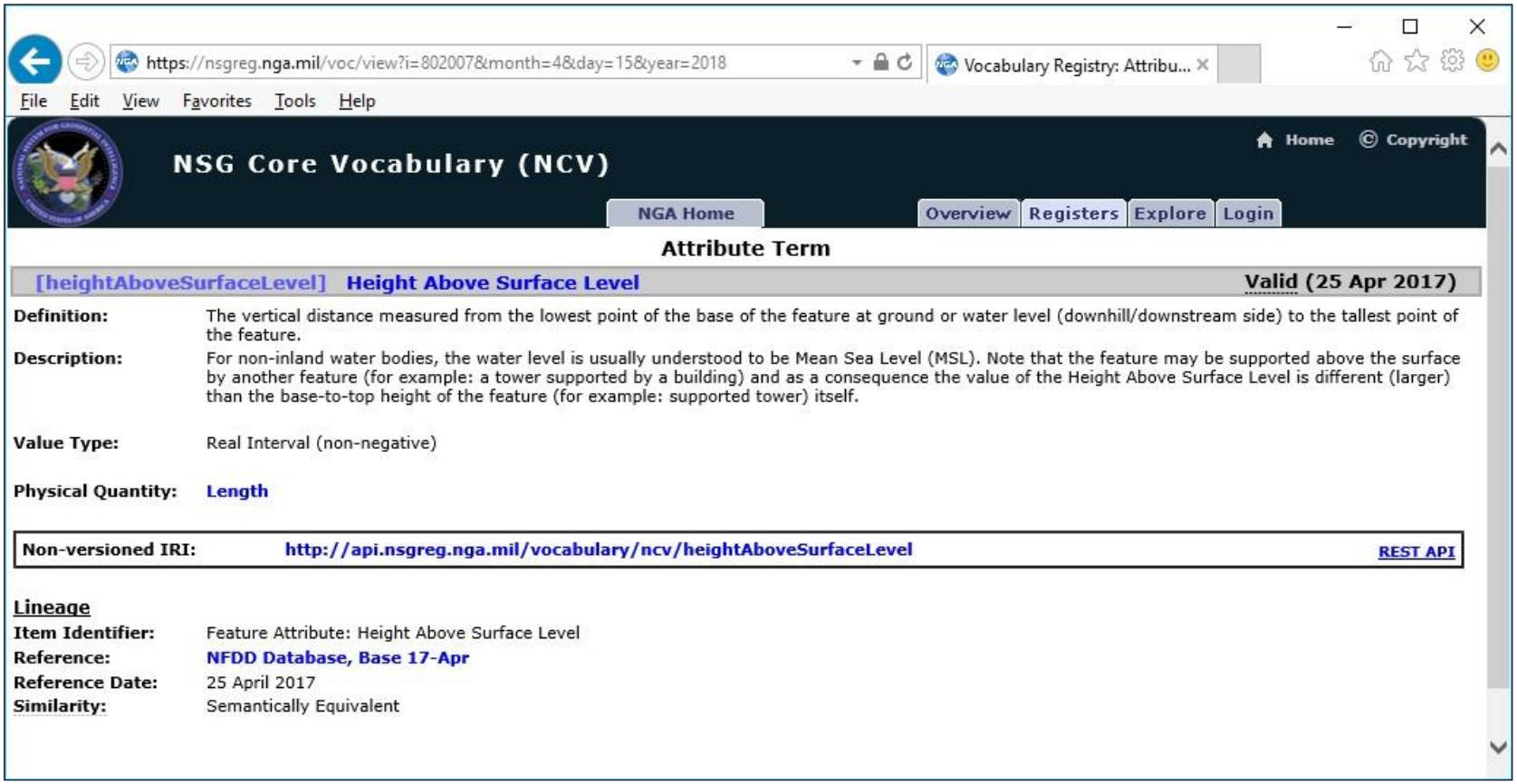


Figure 14 – NCV Register Entry for AttributeTerm "Height Above Surface Level"

NCV Register entries for EnumeratedTypeTerms include a table of the ListedValueTerms that belong to that EnumeratedTypeTerm. Indentation is used to show broader and narrower relationships between the members of hierarchical sets of Listed Values, as shown in Figure 15.

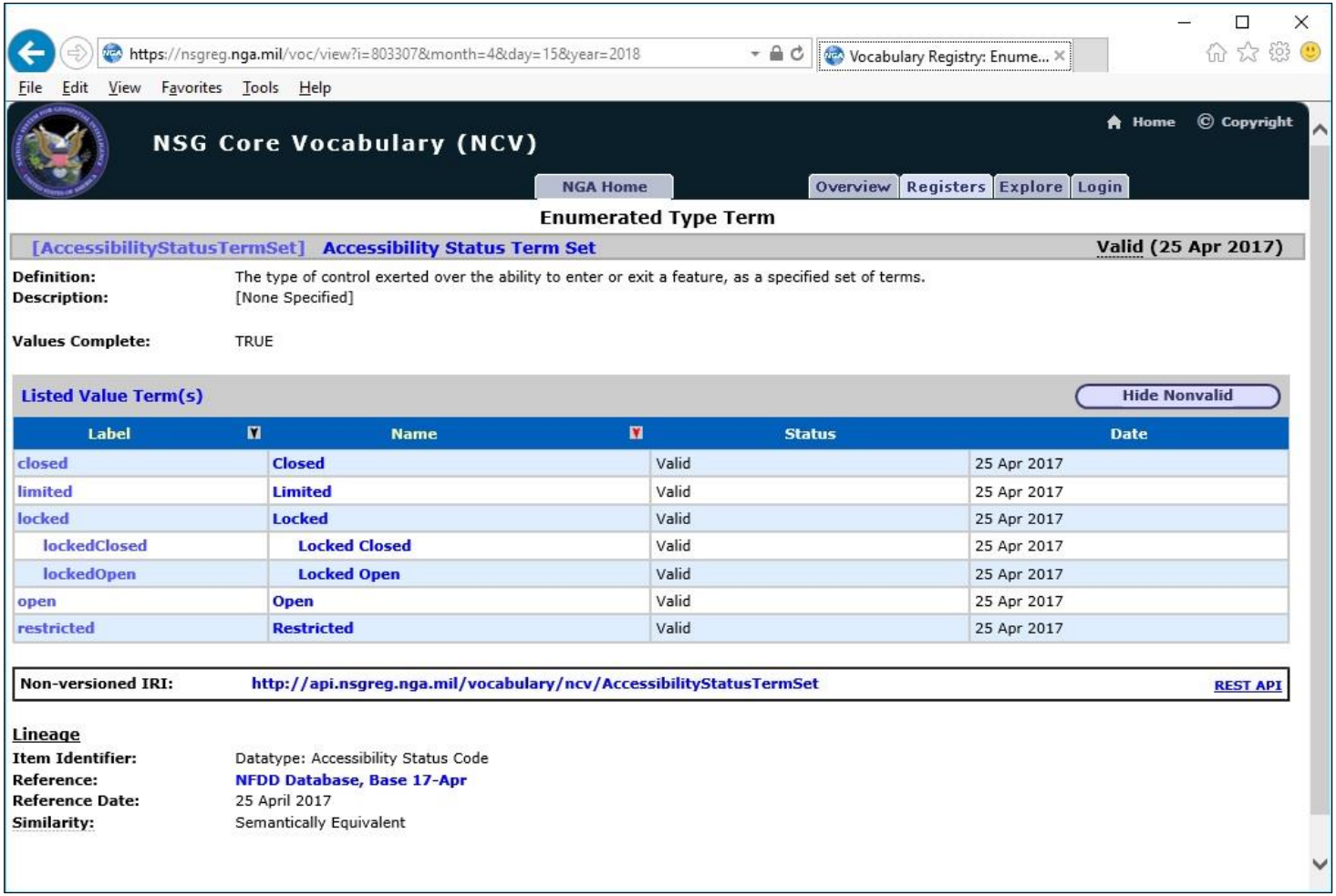


Figure 15 – NCV Register Entry for Hierarchical EnumeratedTypeTerm "Accessibility Status Term Set"

It is important to note the status of a given term (shown on the right-hand-side of the grey title bar) in the NCV Register, because the content of the NCV Register spans multiple content baselines. The NCV Register therefore includes terms that may have been superseded or retired, as well as terms that are valid, on the date specified for a given query. Queries default to the current date, but the browse and search filters may be used to override that default.

E.3 *Examining NCV Content Encodings*

The NCV content is represented in SKOS and published in two W3C encodings, RDF/XML and N-triples. NCV encodings include (1) registered resources (technical artifacts) published in the online NSG Standards Registry, and (2) online resources available through the REST API component of the NSG Registry. The primary purpose of the encodings is to provide machine-processable semantic information for use by applications and data in the NSG. While this includes English-language material for presentation to humans using applications, the encodings themselves are large files not especially amenable to human consumption. However, these files may be used to examine the encoding of the NCV in accordance with the NSG vocabulary specification.

Note that the concepts defined in the NSG vocabulary information model (Section 5.3) are mapped to encoding elements (Section 5.5.4 and Section 5.5.5). *BasicVocabularyTerm* is encoded using `ncvx:BasicVocabularyTerm` (defined as a subclass of `skos:Concept`); *ComplexVocabularyTerm* is encoded using `ncvx:ComplexVocabularyTerm` (defined as a subclass of `skos:ConceptScheme`). Other concepts in the NSG vocabulary information model also have their encoding counterparts. For example, the role property memberTermOf in the information model is encoded in SKOS using `skos:inScheme` (Table 17 (row 16)). These encoding elements are used in the technical artifacts.

E.3.1 Reading NCV Content Encodings in a Text Editor

A text editor, such as Notepad, is a simple and widely available tool for inspecting the NCV encodings. A text editor enables one to see the syntax of the encodings. Figure 16 shows the RDF/XML encoding, as displayed in Notepad, for the AttributeTerm with the label (encoded using `rdfs:label`) `heightAboveSurfaceLevel`. AttributeTerms, a subcategory of *BasicVocabularyTerm*, are encoded using `ncvx:BasicVocabularyTerm`. In the encoding, the `skos:definition` includes all parts of the definitionNote that are displayed separately in the NCV Register entry. The content of the `skos:definition` may be enclosed in a CDATA wrapper (see Section 5.5.6.2).

```
    <ncvx:BasicVocabularyTerm
rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/heightAboveSurfaceLevel">
        <rdfs:label xml:lang="en">heightAboveSurfaceLevel</rdfs:label>
        <skos:prefLabel xml:lang="en"><![CDATA[Height Above Surface Level]]></skos:prefLabel>
        <skos:definition xml:lang="en"><![CDATA[Definition: The vertical distance measured from
the lowest point of the base of the feature at ground or water level (downhill/downstream side)
to the tallest point of the feature.  Description: For non-inland water bodies, the water level
is usually understood to be Mean Sea Level (MSL). Note that the feature may be supported above
the surface by another feature (for example: a tower supported by a building) and as a
consequence the value of the Height Above Surface Level is different (larger) than the base-to-
top height of the feature (for example: supported tower) itself.  Value Type: Real Interval (non-
negative).  Physical Quantity: Length]]></skos:definition>
        <rdfs:isDefinedBy rdf:resource="http://nsgreg.nga.mil/voc/view?i=802007"/>
        <ncvx:termCategory>attribute</ncvx:termCategory>
        <dct:isPartOf rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv"/>
        <regx:itemStatus>valid</regx:itemStatus>
        <regx:dateAccepted>2016-10-25T00:00:00Z</regx:dateAccepted>
    </ncvx:BasicVocabularyTerm>
```

Figure 16 – NCV Encoding for the AttributeTerm `heightAboveSurfaceLevel`

The EnumeratedTypeTerm `AccessibilityStatusTermSet` is encoded using `ncvx:ComplexVocabularyTerm`, as shown in Figure 17. Note that only the top concepts of the EnumeratedTypeTerm are included in the term declaration. (Compare that with the NCV Register view, in which all member ListedValueTerms are displayed.)

```
    <ncvx:ComplexVocabularyTerm
rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet">
        <rdfs:label xml:lang="en">AccessibilityStatusTermSet</rdfs:label>
        <skos:prefLabel xml:lang="en"><![CDATA[Accessibility Status Term Set]]></skos:prefLabel>
        <skos:definition xml:lang="en"><![CDATA[Definition: The type of control exerted over the
ability to enter or exit a feature, as a specified set of terms.  Description: [None
Specified]]]></skos:definition>
        <rdfs:isDefinedBy rdf:resource="http://nsgreg.nga.mil/voc/view?i=803307"/>
        <skos:hasTopConcept
rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/closed"/>
        <skos:hasTopConcept
rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/limited"/>
        <skos:hasTopConcept
rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/locked"/>
        <skos:hasTopConcept
rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/open"/>
        <skos:hasTopConcept
rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/restricted"/>
        <ncvx:termCategory>enumeratedType</ncvx:termCategory>
        <ncvx:domainComplete>true</ncvx:domainComplete>
        <dct:isPartOf rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv"/>
        <regx:itemStatus>valid</regx:itemStatus>
        <regx:dateAccepted>2016-10-25T00:00:00Z</regx:dateAccepted>
    </ncvx:ComplexVocabularyTerm>
```

Figure 17 – NCV Encoding for the EnumeratedTypeTerm `AccessibilityStatusTermSet`

In the encoding files, narrower terms and broader terms of ListedValueTerms are specified within the definition of the ListedValueTerms, as shown below in Figure 18, for the narrower terms of the ListedValueTerm `locked`, belonging to the EnumeratedTypeTerm `AccessibilityStatusTermSet`. The encoding for narrowerBasicTerm is `skos:narrower`. The relationship of the ListedValueTerm to its EnumeratedTypeTerm is indicated in three ways: (1) by the inclusion of the label of the EnumeratedTypeTerm in the IRI for the ListedValueTerm; (2) by the inclusion of the label of the EnumeratedTypeTerm (using the separator "." (dot-notation)) in the label of the ListedValueTerm; and (3) by the `skos:inScheme` (memberTermOf*)* declaration.

```
    <ncvx:BasicVocabularyTerm
rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/locked">
        <rdfs:label xml:lang="en">AccessibilityStatusTermSet.locked</rdfs:label>
        <skos:prefLabel xml:lang="en"><![CDATA[Locked (Accessibility Status)]]></skos:prefLabel>
        <skos:definition xml:lang="en"><![CDATA[Definition: Access requires a special means to
pass and/or close and prevent future passage (for example: a key.  Description: The entrance to
the feature may be covered and/or blocked by a physical barrier.]></skos:definition>
        <rdfs:isDefinedBy rdf:resource="http://nsgreg.nga.mil/voc/view?i=804304"/>
        <skos:inScheme
rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet"/>
        <skos:topConceptOf
rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet"/>
        <skos:narrower
rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/lockedClosed"/>
        <skos:narrower
rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/lockedOpen"/>
        <ncvx:termCategory>listedValue</ncvx:termCategory>
        <dct:isPartOf rdf:resource="http://api.nsgreg.nga.mil/vocabulary/ncv"/>
        <regx:itemStatus>valid</regx:itemStatus>
        <regx:dateAccepted>2016-10-25T00:00:00Z</regx:dateAccepted>
    </ncvx:BasicVocabularyTerm>
```

Figure 18 – NCV Encoding for the ListedValueTerm `locked` **with Two Narrower Terms**

The full list of ListedValueTerms belonging to the same EnumeratedTypeTerm can be seen in the DifferentTerms declaration (Figure 19).

```
    <owl:AllDifferent>
        <owl:distinctMembers rdf:parseType="Collection">
            <rdf:Description
rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/closed"/>
            <rdf:Description
rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/limited"/>
            <rdf:Description
rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/locked"/>
            <rdf:Description
rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/lockedClosed"/>
            <rdf:Description
rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/lockedOpen"/>
            <rdf:Description
rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/open"/>
            <rdf:Description
rdf:about="http://api.nsgreg.nga.mil/vocabulary/ncv/AccessibilityStatusTermSet/restricted"/>
        </owl:distinctMembers>
    </owl:AllDifferent>
```

Figure 19 – NCV Encoding of the DifferentTerms Axiom for `AccessibilityStatusTermSet`

Selective examination of the content of NCV technical artifacts in a text editor is useful for understanding the syntax of the encodings. Examples of how Notepad displays the N-Triples encoding for `AccessibilityStatusTermSet` may be found in Figure 7 (EnumeratedType term-declaration) and Figure 8 (the DifferentTerms axiom) of Section 5.5.6.3.

E.3.2 Exploring NCV Content Encodings using the Protégé Ontology Tool

The Protégé ontology editor developed by Stanford University is a free, open-source ontology development tool. Protégé is available for download online at http://protege.stanford.edu (which also hosts documentation and training materials). Protégé is designed primarily as an ontology editor for ontologies constructed in the W3C Web Ontology Language (OWL). While Protégé is not natively a vocabulary viewer, it may be used to view items in the NCV content because SKOS, the encoding format for the NCV, is itself defined in OWL. The following sections explain how to examine elements of an NCV content encoding file using Protégé (version 5.2.0). The example assumes the use of an encoding file containing a complete content baseline.

Protégé can load either the RDF/XML and N-Triples encodings. It is recommended to load these from a local copy of the files (for N-Triples, select "All Files" in the Open dialogue).[31] It should be noted that the size of NCV encoding files containing a complete content baseline may result in slow performance by Protégé when loading different graphic presentations.

Protégé opens on the Active Ontologies tab (its "home" tab). For readability, in the Protégé display select "Render by label (`rdfs:label`)" from the View menu. This enables Protégé to display better human-readable labels for the vocabulary terms (including labels that use dot-notation to display the Listed Values within the context of their Enumerated Type (*e.g.*, "AccessibilityStatusTermSet.locked").

Exploration should start on the Class hierarchy tab (choosing "Classes", then "Class hierarchy" on the lower left). The class `VocabularyTerm` appears in the hierarchy in the left-hand panel and should be expanded to show its subclasses, `BasicVocabularyTerm` and `ComplexVocabularyTerm`. Protégé does not display NCV vocabulary terms in the Class hierarchy tab because the terms are individuals (not classes). To explore an NCV content baseline, select either `BasicVocabularyTerm` or `ComplexVocabularyTerm` from the left-hand panel. The list of Instances for the selected class may be found by scrolling down in the "Description" panel in the lower right. Panel size in the Protégé GUI may be adjusted by dragging the panel boundaries. A panel may also be floated or closed using buttons on the upper-right side of the panel header.

The illustrations in the following figures are made with the NCV version 2-1 content baseline (in RDF/XML) loaded in Protégé 5.2.0. Figure 20 on the next page shows the Protégé Class Hierarchy panel with Instances of `ComplexVocabularyTerm` in the NCV content (*i.e.*, EnumeratedTypeTerms). Instances are listed in alphabetical order, using the values of `rdfs:label` for display (selected in the View menu). The "Description" panel with the list of EnumeratedTypeTerms can be "floated" by clicking the icon on the upper right header bar of the lower-right display pane. A floated panel may be resized.

[31] When loading, Protégé may attempt to find external resources referenced by the NSG Core Vocabulary encoding. If those are not accessible from the system where Protégé is installed, Protégé will prompt the user to resolve the issue. Two options are available: (1) Click "No" to have Protégé proceed without accessing the external resources; this will not affect viewing the NCV content; (2) locate and copy the external resources and provide them in files accessible to Protégé within the installation system (users may need to consult their system administrators).

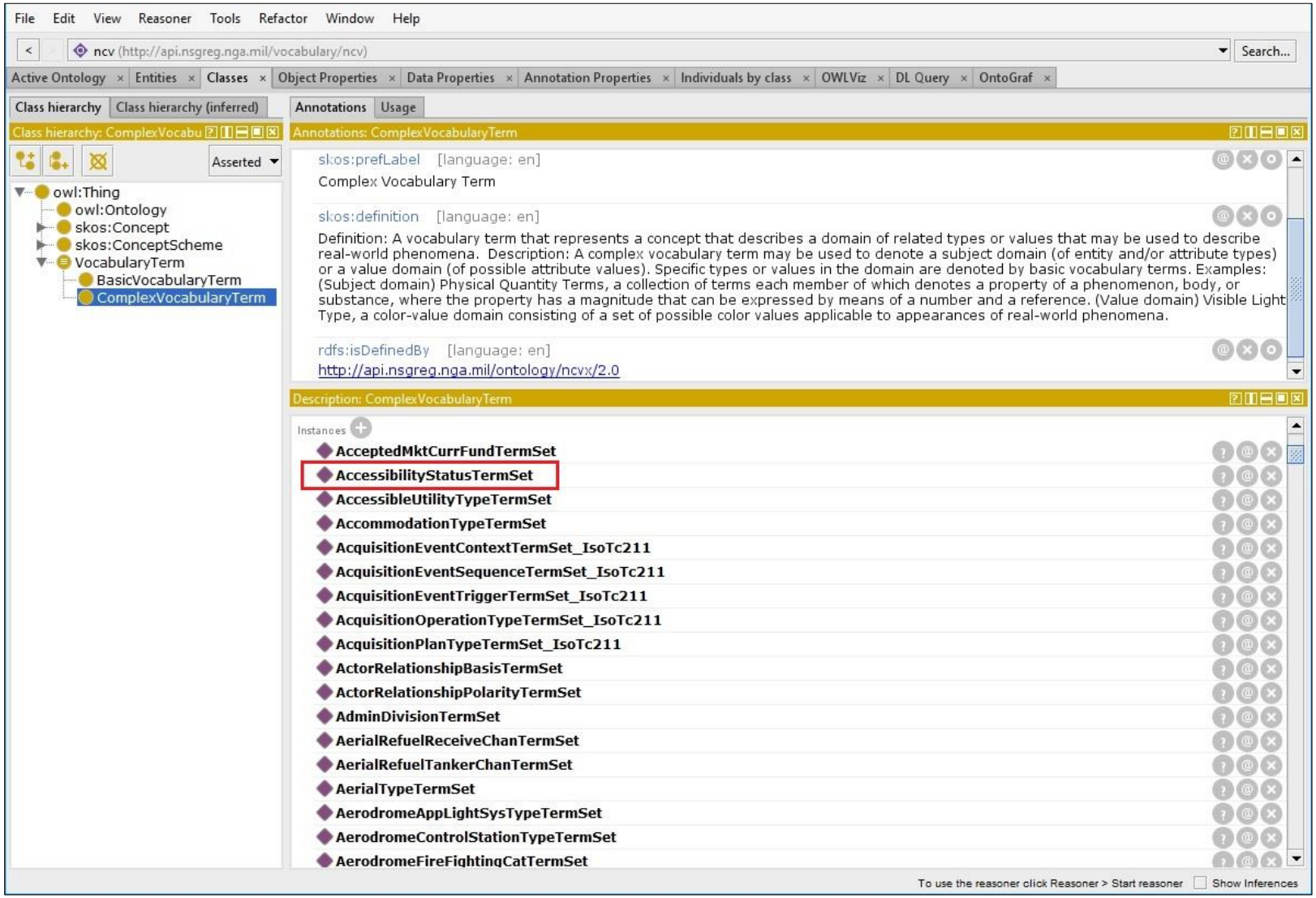


Figure 20 – Protégé GUI with Instances of Complex Vocabulary Terms (Example: `AccessibilityStatusTermSet`)

Selecting an instance (for example: `AccessibilityStatusTermSet`) opens the detail view of that instance in the Protégé GUI (Figure 21). The “Individual Usage” tab (selected below) shows all assertions about that term, including metadata about when the term was accepted into the NCV (*dateAccepted*), its status (‘valid’), the top concepts of the set, and that the set of values is closed (*i.e.*, because *domainComplete* = ‘TRUE’).

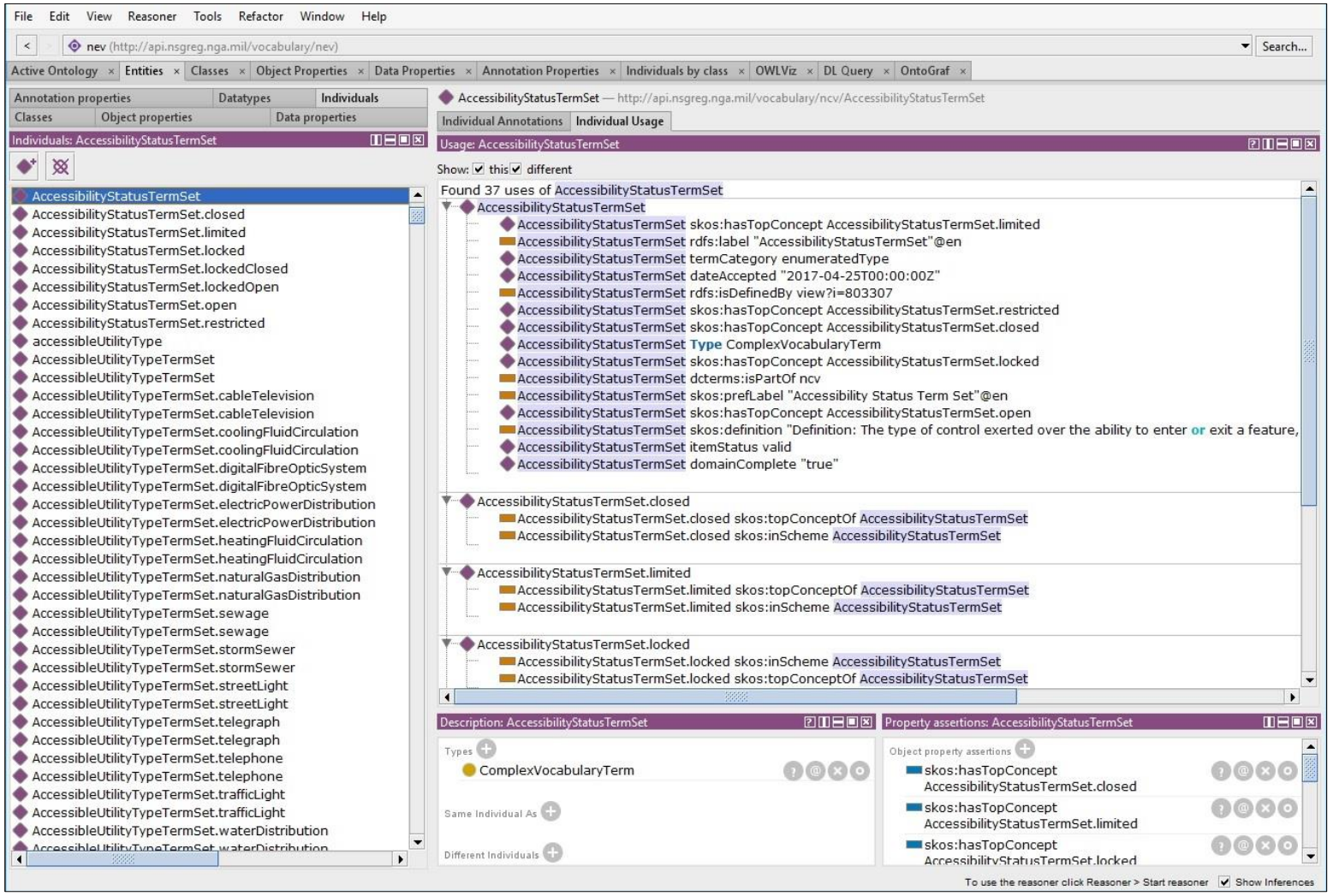


Figure 21 – Protégé Detail View for the EnumeratedTypeTerm `AccessibilityStatusTermSet`

The same process can be used to explore Instances of `BasicVocabularyTerm` (which encodes NCV EntityTerms, AttributeTerms, and ListedValueTerms). In Figure 22, the ListedValueTerms that are members of `AccessibilityStatusTermSet` are shown in the list of instances.

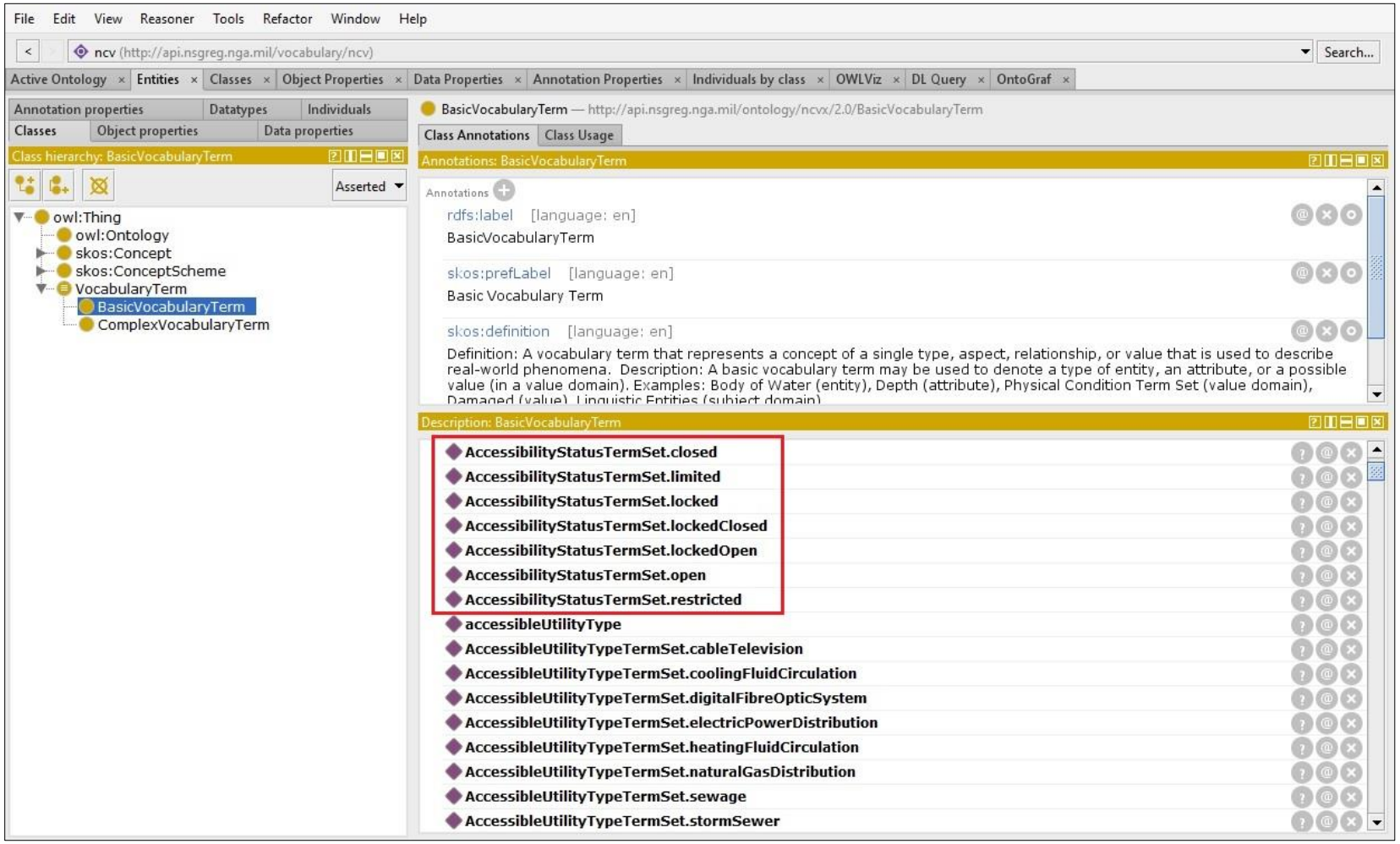


Figure 22 – Protégé GUI with ListedValueTerms (Example: members of `AccessibilityStatusTermSet`)

Figure 23 shows the Protégé detail view of the ListedValueTerm `locked` from the `AccessibilityStatusTermSet` (compare with text format in Figure 18).

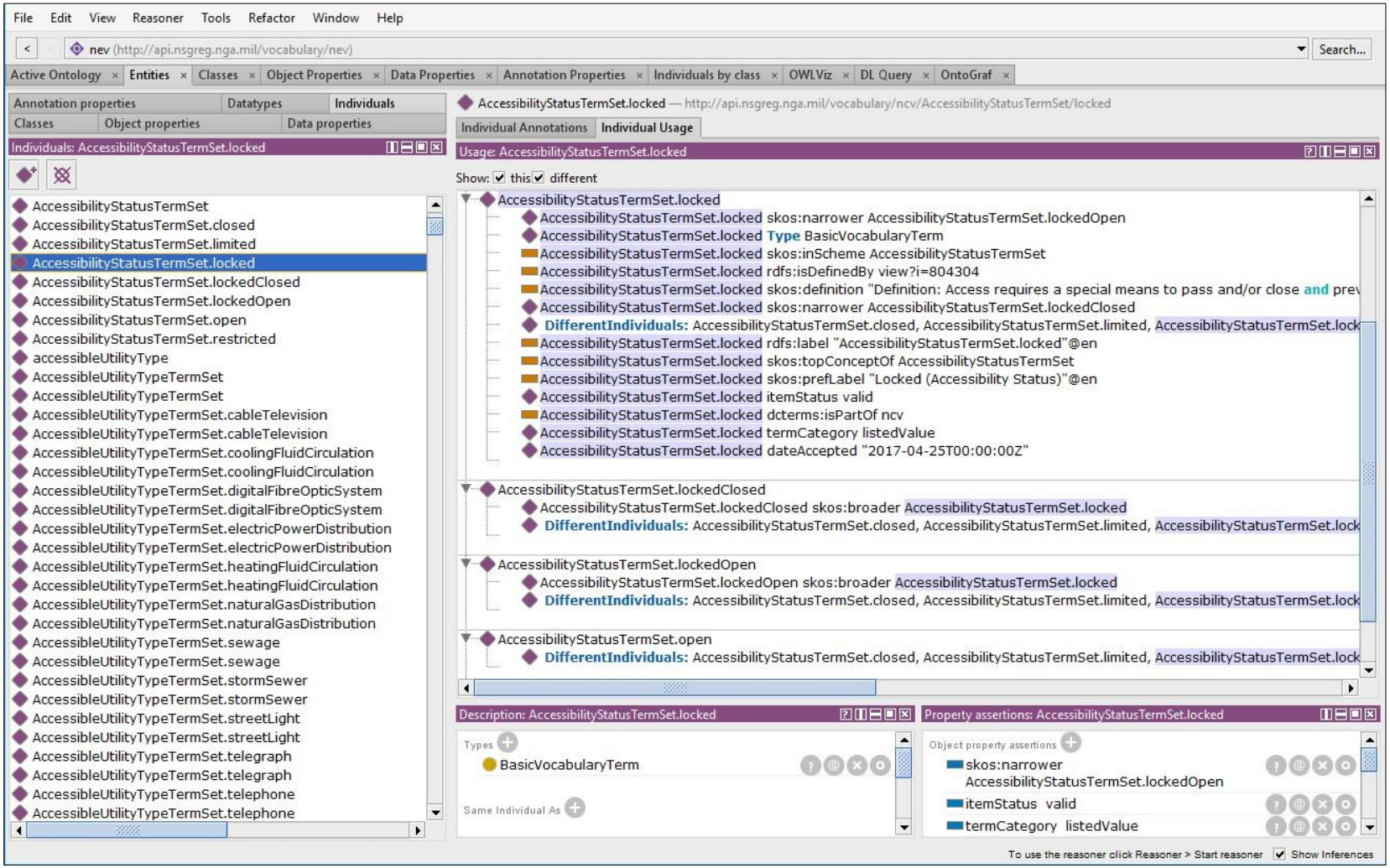


Figure 23 – Protégé Detail View for the ListedValueTerm `AccessibilityStatusTermSet.locked`

E.4 *NCV Content in the NSG Enterprise Vocabulary (NEV) Workbook*

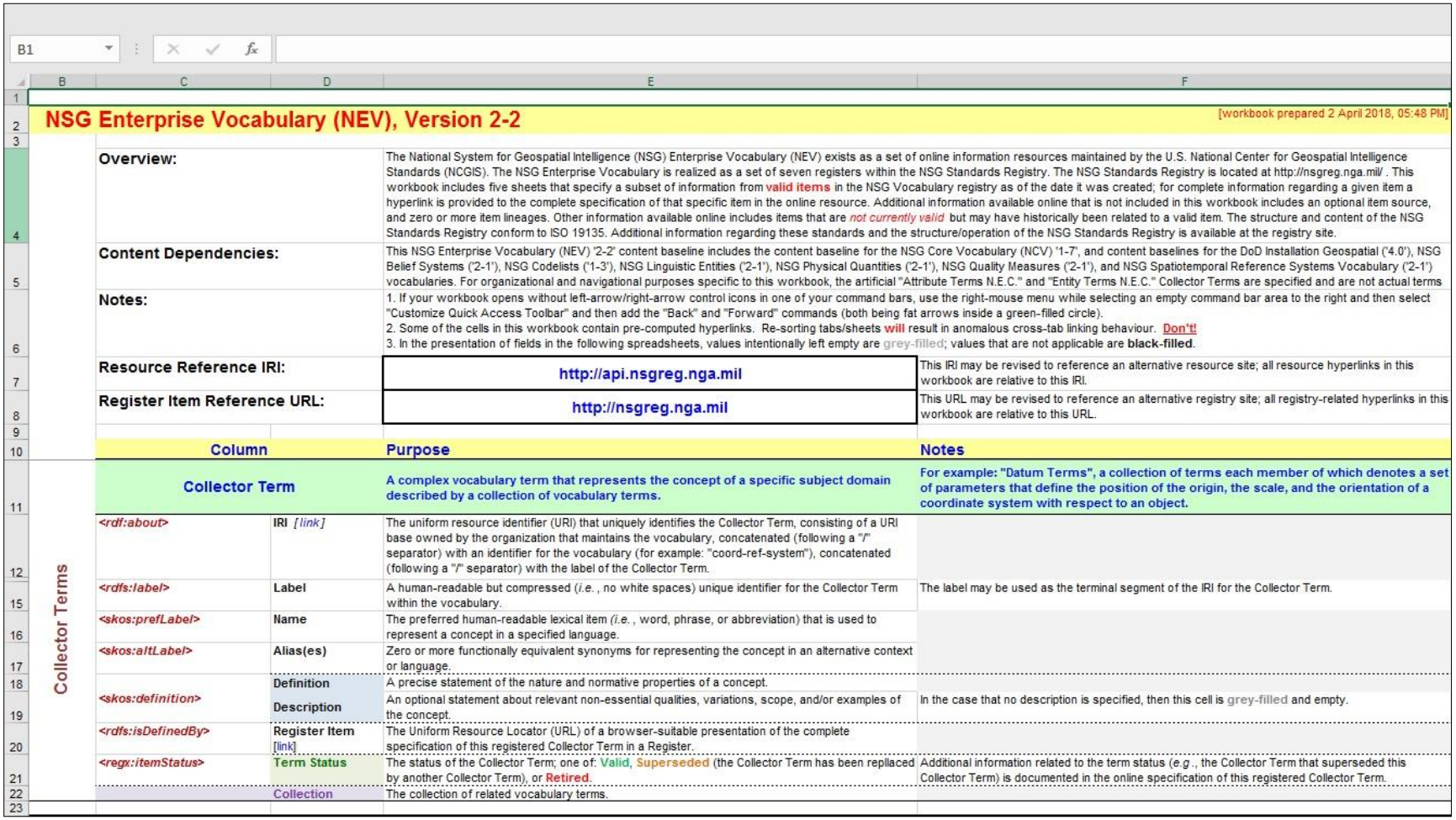
The NCV content is also published in an Excel workbook that is an informative resource created solely for user convenience. The NSG Enterprise Vocabulary (NEV) Workbook includes a cover sheet (Figure 24) explaining the format of the workbook and five content worksheets that specify a subset of information from valid items in the NSG Vocabulary Registry as of the date the NEV Workbook was created. For complete information regarding a given item, a hyperlink is provided to the complete specification of that specific item in the online resource. Additional information available online that is not included in the workbook includes an optional item source, and zero or more item lineages. Other information available online includes items that are not currently valid but may have historically been related to a valid item.

Worksheet tabs are color-coded to distinguish complex vocabulary terms (CollectorTerms, EnumeratedTypeTerms) from basic vocabulary terms (EntityTerms, AttributeTerms, ListedValueTerms), categories that are explained in the NCV Standard (Sections 5.3.3 and 5.3.4).[32] In the presentation of fields in the worksheets, values intentionally left empty are grey-filled; values that are not applicable are black-filled.

The NEV Workbook is searchable by using Excel filters (in Data tools on the Ribbon) on one or more columns of the content worksheets. NCV content may be viewed by filtering the column with header “Label [*link*]” (in row 2) using either the Search box or the Text Filter with the string “/ncv/” to view terms from the NCV namespace only (Column A on the worksheets for CollectorTerms and EnumeratedTypeTerms; Column C on the worksheets for EntityTerms, AttributeTerms, and ListedValueTerms). Figure 25 shows the NEV Workbook worksheet for ListedValueTerms, with the set of terms for AccessibilityStatusTermSet outlined as an example.

Note: Users should ensure that left-arrow/right-arrow control icons are available in their command bars. If the workbook opens without left-arrow/right-arrow control icons in the command bars, use the right-mouse menu while selecting an empty command bar area to the right, select "Customize Quick Access Toolbar", and then add the "Back" and "Forward" commands (both being fat arrows inside a green-filled circle). Some cells in the workbook contain pre-computed hyperlinks (see Figure 25, Column A). Re-sorting tabs/worksheets will result in anomalous cross-tab linking behavior and is therefore advised against.

[32] The NCV content does not contain CollectorTerms. CollectorTerms are used in other NEV component vocabularies.



NSG Enterprise Vocabulary (NEV), Version 2-2

[workbook prepared 2 April 2018, 05:48 PM]

Overview:	The National System for Geospatial Intelligence (NSG) Enterprise Vocabulary (NEV) exists as a set of online information resources maintained by the U.S. National Center for Geospatial Intelligence Standards (NCGIS). The NSG Enterprise Vocabulary is realized as a set of seven registers within the NSG Standards Registry. The NSG Standards Registry is located at http://nsgreg.nga.mil/ . This workbook includes five sheets that specify a subset of information from **valid items** in the NSG Vocabulary registry as of the date it was created; for complete information regarding a given item a hyperlink is provided to the complete specification of that specific item in the online resource. Additional information available online that is not included in this workbook includes an optional item source, and zero or more item lineages. Other information available online includes items that are *not currently valid* but may have historically been related to a valid item. The structure and content of the NSG Standards Registry conform to ISO 19135. Additional information regarding these standards and the structure/operation of the NSG Standards Registry is available at the registry site.
Content Dependencies:	This NSG Enterprise Vocabulary (NEV) '2-2' content baseline includes the content baseline for the NSG Core Vocabulary (NCV) '1-7', and content baselines for the DoD Installation Geospatial ('4.0'), NSG Belief Systems ('2-1'), NSG Codelists ('1-3'), NSG Linguistic Entities ('2-1'), NSG Physical Quantities ('2-1'), NSG Quality Measures ('2-1'), and NSG Spatiotemporal Reference Systems Vocabulary ('2-1') vocabularies. For organizational and navigational purposes specific to this workbook, the artificial "Attribute Terms N.E.C." and "Entity Terms N.E.C." Collector Terms are specified and are not actual terms
Notes:	1. If your workbook opens without left-arrow/right-arrow control icons in one of your command bars, use the right-mouse menu while selecting an empty command bar area to the right and then select "Customize Quick Access Toolbar" and then add the "Back" and "Forward" commands (both being fat arrows inside a green-filled circle). 2. Some of the cells in this workbook contain pre-computed hyperlinks. Re-sorting tabs/sheets **will** result in anomalous cross-tab linking behaviour. Don't! 3. In the presentation of fields in the following spreadsheets, values intentionally left empty are grey-filled; values that are not applicable are **black-filled**.
Resource Reference IRI:	**http://api.nsgreg.nga.mil** — This IRI may be revised to reference an alternative resource site; all resource hyperlinks in this workbook are relative to this IRI.
Register Item Reference URL:	**http://nsgreg.nga.mil** — This URL may be revised to reference an alternative registry site; all registry-related hyperlinks in this workbook are relative to this URL.

	Column		Purpose	Notes
Collector Terms	**Collector Term**		**A complex vocabulary term that represents the concept of a specific subject domain described by a collection of vocabulary terms.**	**For example: "Datum Terms", a collection of terms each member of which denotes a set of parameters that define the position of the origin, the scale, and the orientation of a coordinate system with respect to an object.**
	<rdf:about>	**IRI** *[link]*	The uniform resource identifier (URI) that uniquely identifies the Collector Term, consisting of a URI base owned by the organization that maintains the vocabulary, concatenated (following a "/" separator) with an identifier for the vocabulary (for example: "coord-ref-system"), concatenated (following a "/" separator) with the label of the Collector Term.	
	<rdfs:label>	**Label**	A human-readable but compressed (*i.e.* , no white spaces) unique identifier for the Collector Term within the vocabulary.	The label may be used as the terminal segment of the IRI for the Collector Term.
	<skos:prefLabel>	**Name**	The preferred human-readable lexical item (*i.e.* , word, phrase, or abbreviation) that is used to represent a concept in a specified language.	
	<skos:altLabel>	**Alias(es)**	Zero or more functionally equivalent synonyms for representing the concept in an alternative context or language.	
	<skos:definition>	**Definition**	A precise statement of the nature and normative properties of a concept.	
		Description	An optional statement about relevant non-essential qualities, variations, scope, and/or examples of the concept.	In the case that no description is specified, then this cell is grey-filled and empty.
	<rdfs:isDefinedBy>	**Register Item** [link]	The Uniform Resource Locator (URL) of a browser-suitable presentation of the complete specification of this registered Collector Term in a Register.	
	<regx:itemStatus>	**Term Status**	The status of the Collector Term; one of: **Valid**, **Superseded** (the Collector Term has been repllaced by another Collector Term), or **Retired**.	Additional information related to the term status (*e.g.*, the Collector Term that superseded this Collector Term) is documented in the online specification of this registered Collector Term.
		Collection	The collection of related vocabulary terms.	

Figure 24 – NEV Workbook Cover Worksheet

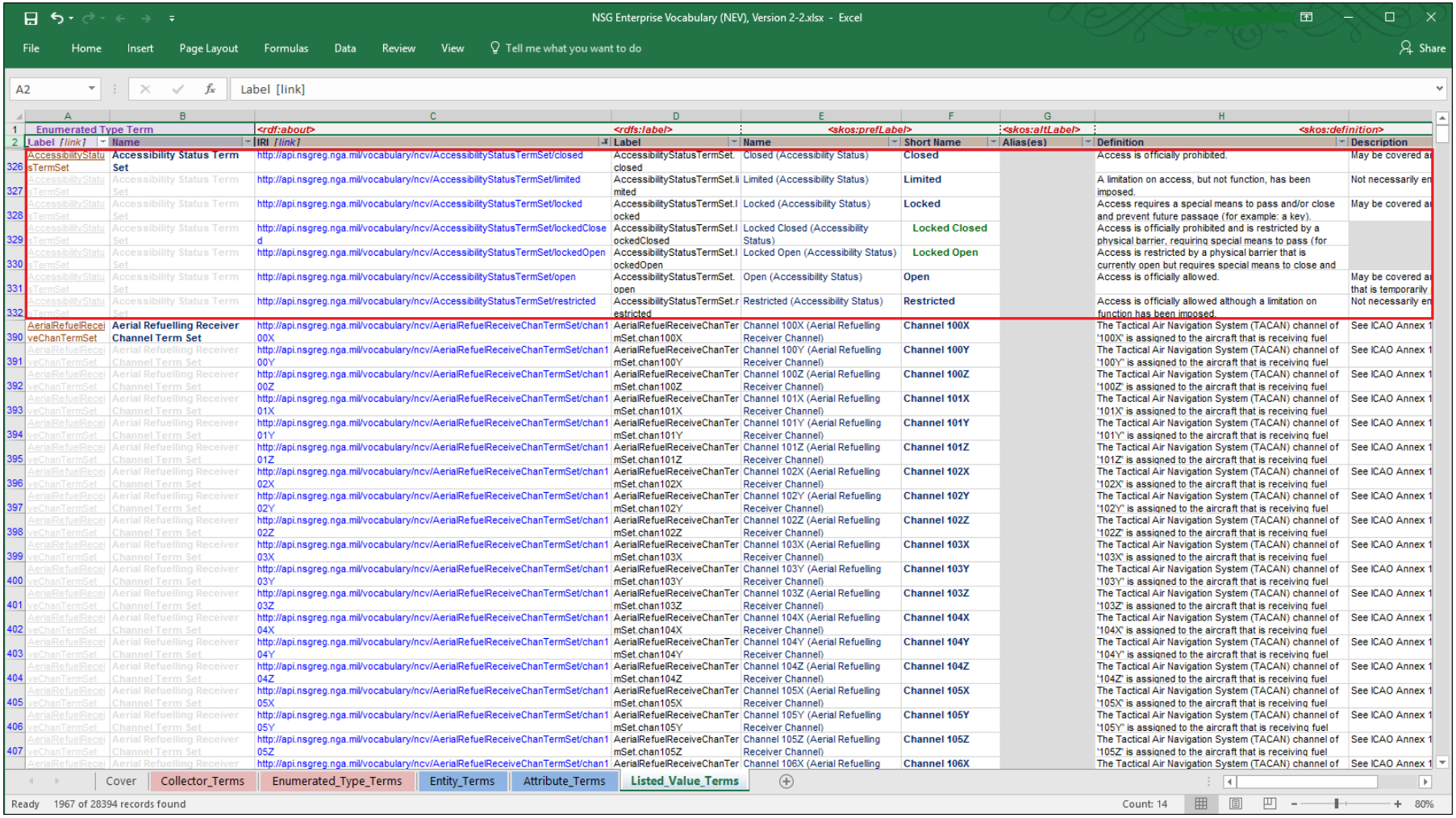


Figure 25 – NEV Workbook Showing Listed ValueTerms Tab (with Members of `AccessibilityStatusTermSet`)

Annex F – UML Primer

(Informative)

F.1 *UML Notations*

The diagrams that appear in this document are presented using the Unified Modeling Language (UML) static structure diagram with the ISO Interface Definition Language basic type definitions and the UML Object Constraint Language (OCL) as the conceptual schema language. The UML notations used in this standard are described in Figure 26.

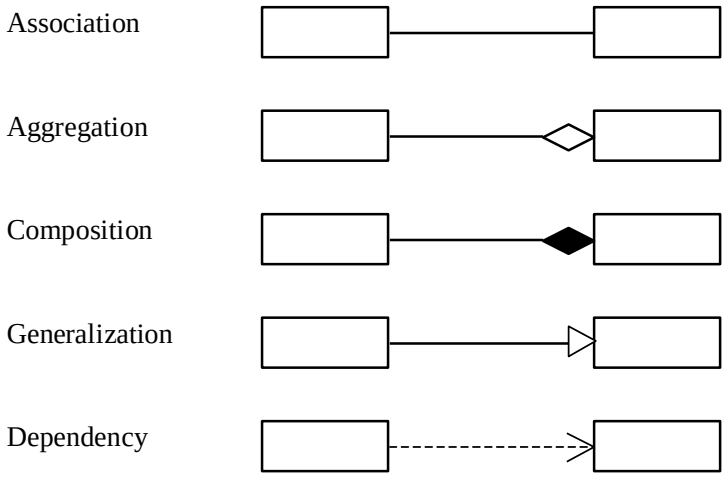


Figure 26 – UML Notation

F.2 *UML Model Relationships*

F.2.1 Associations

An association is used to describe a relationship between two or more classes. UML defines three different types of relationships, called association, aggregation and composition. The three types have different semantics. An ordinary association shall be used to represent a general relationship between two classes. The aggregation and composition associations shall be used to create part-whole relationships between two classes.

An aggregation association is a relationship between two classes in which one of the classes plays the role of container and the other plays the role of a containee.

A composition association is a strong aggregation. In a composition association, if a container object is deleted, then all of its containee objects are deleted as well. The composition association shall be used when the objects representing the parts of a container object cannot exist without the container object.

F.2.2 Navigation

Associations may be navigable in only one direction. If the direction is not specified, it is assumed to be a two-way association. If one-way associations are intended, the direction of the association can be marked by an arrow at the navigable end of the line. Navigability means that instances participating in links at runtime (instances of an association) can be accessed efficiently from instances participating in links at the other end of the association. The precise mechanism by which such access is achieved is implementation specific. If an end is not navigable, access from the other ends may or may not be possible, and if it is, it might not be efficient.

F.2.3 Generalization

A generalization is a relationship between a superclass and the subclasses that may be substituted for it. The superclass is the generalized class, while the subclasses are specified classes.

F.2.4 Instantiation / Dependency

A dependency relationship shows that the client class depends on the supplier class/interface to provide certain services, such as:

- Client class accesses a value (constant or variable) defined in the supplier class/interface;
- Operations of the client class invoke operations of the supplier class/interface;
- Operations of the client class have signatures whose return class or arguments are instances of the supplier class/interface.

An instantiated relationship represents the act of substituting actual values for the parameters of a parameterized class or parameterized class utility to create a specialized version of the more general item.

F.2.5 Roles

If an association is navigable in a particular direction, the model shall supply a “role name” that is appropriate for the role of the target object in relation to the source object. Thus, in a two-way association, two role names will be supplied. Figure 27 represents how role names and cardinalities are expressed in UML diagrams.

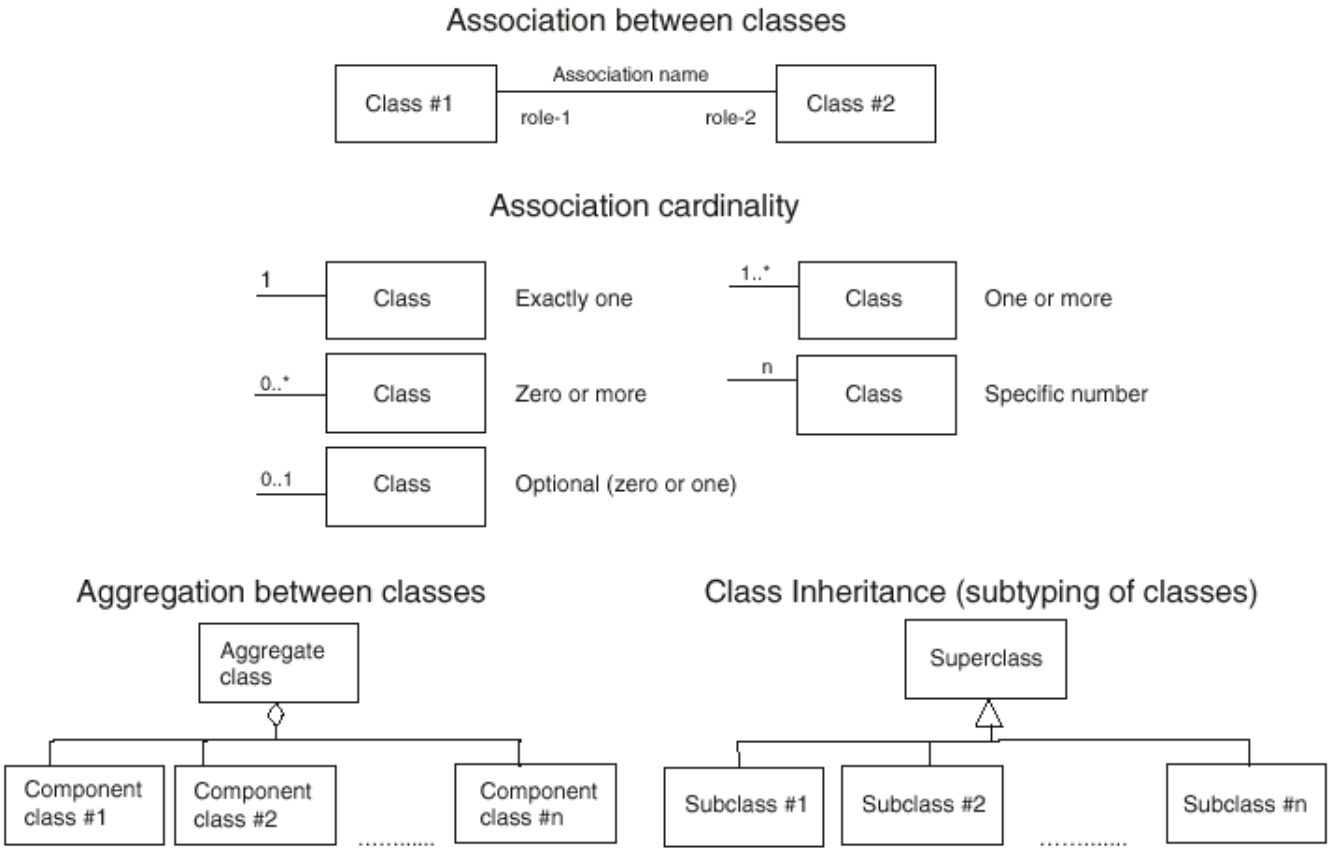


Figure 27 – UML Roles

F.3 *UML Model Stereotypes*

A UML stereotype is an extension mechanism for existing UML concepts. It is a model element that is used to classify (or mark) other UML elements so that they in some respect behave as if they were instances of new virtual or pseudo metamodel classes whose form is based on existing base metamodel classes. Stereotypes augment the classification mechanisms on the basis of the built-in UML metamodel class hierarchy. Below are brief descriptions of the stereotypes used in this document.

a. <<enumeration>> datatype whose instances form a list of named literal values. Both the enumeration name and its literal values are declared. Enumeration means a short list of well-understood potential values within a class.

b. <<dataType>> a descriptor of a set of values that lack identity and whose operations do not have side effects. Datatypes include primitive pre-defined types and user-definable types. Pre-defined types include numbers, string, and time. User-definable types include enumerations.

c. <<codeList>> used to describe a more open enumeration. <<codeList>> is a flexible enumeration. Code lists are useful for expressing a long list of potential values. If the elements of the list are completely known, an enumeration should be used; if the only likely values of the elements are known, a code list should be used.